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THE JOURNAL OF DENTAL EDUCATION

A QUARTERLY FOR THE DENTAL TEACHER

VOLUME 16 MAY, 1952 NUMBER 3

"An ignorant man has been defined as one whom God has packed up and men have not unfolded."
NEWELL DWIGHT HILLIS

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A Conference Session will be held during the 1953 Annual Meeting on dental hygienist educational programs. A committee has been appointed to conduct the Session: Margaret A. Bailey, Evelyn Hannon, Margaret E. Swanson, Gerald D. Timmons, Temple University, *Chairman*.

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"Character is more than intellect. A great soul will be strong to live, as well as to think. Goodness outshines genius, as the sun makes the electric light cast a shadow."

—EMERSON.

EDITORIAL

The 1952 Session

The American Association of Dental Schools is 29 years old in this year of our Lord, 1952. It was in Cleveland, 1923, immediately prior to the annual meeting of the American Dental Association that three bodies of dental educators were brought together and asked to lay down all their records and paraphernalia of whatever kind, to organize this new body. It was between 1910 and 1912, that James G. Sharp,[1] President of the Dental Faculties Association of American Universities, recommended to that body that the Carnegie Foundation for the Advancement of Learning be asked to make a survey of dental education, and recommendations for advancement within that field.[2] Without going into further details, this request was granted and Dr. William J. Gies, Professor of Biochemistry, Columbia University Medical School, was selected to make that survey and recommendation.[3] After some preliminary effort various interested bodies through their authorized agents took hold of the job.

As a result of their labors, somewhere in the neighborhood of 50 per cent of the then existing schools were eliminated or voluntarily closed their doors. The remainder, members of the American Institute of Dental Teachers, the Canadian Dental School Association, and the Dental Faculties Association of American Universities united to form this new body.[4] In these 29 years this body has grown in physical size, in mental strength, and in ethical, moral and professional status until it stands today as a monument honoring those who fought for better things for dentistry and the people who receive its ministrations.[5]

Many factors have entered into this gradual change and time has been required and used to bring it about. We have passed through the eras of part-time teachers, dentists with an altruistic nature, to that of dentists well qualified in the field of pedagogics, that is, men who carry two professions—they are dentists and they are teachers. Along with this has come growth in research, increase in knowledge and understanding, and more and more, not dentists only, but workers in various fields with various degrees, Ph.D., M.A., etc., and technicians, all adding to the scope of education and dental education in particular, and altogether making a mightier profession for greater usefulness.

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[1]Dean, College of Dentistry, University of California, and President, Dental Faculties Association of American Universities.

[2]Proceedings of the Dental Faculties Association of American Universities: President's Address, 1910, p. 4, and 1911, p. 14. See also resolution of that body in general session, 1911, p. 21.

[3]See also Gies, Wm. J.: Bulletin 19; pp. 53, 102, 104, 122 and 124.

[4]See Gurley, John: *J. Am. Coll. Dent.*, 19, 31; 1952 (March).

[5]Horner, H. H.: Dental Education Today; University of Chicago Press, 1947; pp. 188-193.

Specialists and Specialty Boards

Great advance has been made in our professional and educational field within the past few years. This is as it should be, but at the same time we must be wary, for both safety and danger are involved. There is safety due to the fact that we have more knowledge and more understanding, and concomitantly more intelligence in dealing with the ills of a dentally sick public. But there is danger, too. With this super abundance of material and ability, there is an increased tendency to specialize to too great a degree.

The matter of specialization in itself may be an essential and a desirable condition, proof of which is demonstrated almost every day in the conduct of practice. The real specialist, with his greater knowledge concerning specific conditions, can oftentimes give that advice which may save time, strain and expense. But the danger involved lies in the possibility of the specialist or the combined strength of the specialists being put in the anomalous position of the "tail wagging the dog." This fact begins to be manifest in the action of the Specialty Boards. There are those who do not see the need of such boards, but in deference to a younger generation who do desire the possible position which may be thus provided, they are willing to acquiesce. But now they want to accredit schools or pass judgment on schools as to their ability to teach their particular subject.

Therefore, it does not matter what generation may desire this action, nor what generation may sit in judgment, in fact it will be a combination of both. This should not be and to that end the Executive Committee of the American Association of Dental Schools spoke, and passed the following resolution at the last meeting in Colorado Springs:

"The Executive Committee, serving as a Reference Committee to consider the Report of the Advisory Board of Dental Specialties, recommends that this Association appropriate for this year $25 to support the Advisory Board. In reviewing the report, it was observed that it contained the following statement:

" 'The evaluation of training programs in dental schools or in institutions fulfilling the minimum requirements of the Boards was discussed at length. It was pointed out that member Boards would in time be able to examine and approve schools or institutions offering specialty training facilities, and the Council on Dental Education reported that it is planning to use Board members in gathering and evaluating criteria which may be used for this purpose.'

"The Reference Committee, believing that the examination and approval for the purpose of accreditation of schools or institutions offering any phase of dental education should be vested in the Council on Dental Education of the American Dental Association, does not support the specialty boards. This action is taken because it could be construed to mean that accreditation of such schools and institutions would be vested in the specialty boards and not in the Council on Dental Education."

TEACHING CROWN AND BRIDGE PROSTHESIS[1]

ALFRED C. YOUNG, D.D.S.,[2] *Pittsburgh*

For some years this section has been considering the problems found in teaching preclinical crown and bridgework, the best methods to be used, and the skills to be acquired and developed during this part of a dental student's experience. Memory and a partial study of the material presented in these three or four meetings show that we are pretty well agreed upon a preclinical course with rather comprehensive technic work, which is accompanied by a number of explanatory lectures, some didactic, others with a certain amount of visual aides.

The average student enters dental school with an assumed latent ability in craft work. With present admission methods, I believe this average to be higher than in the past. Vocational advisors tell us that a prospective dental student who has not assured himself of his manual dexterity is advised to choose "electives" in arts and crafts; but if he has proved this ability, to select cultural subjects to compensate for the great amount of specific dental education necessary in the professional course.

By the time a student starts our particular preclinical course, he has acquired considerable pertinent knowledge, some general in character, part of it dental. Mathematics, especially geometry, physics, chemistry, metallurgy, dental materials, dental anatomy, and fundamentals of prosthetics as found in the usual dental school full denture curriculum are essential perquisites in this field. Usually certain principles of operative procedures precede the beginning of preclinical crown and bridgework. In the laboratory work which accompanies part of this pre-dental and freshman dental study, skills are developing from the original abilities which are useful in pursuing crown and bridgework. During this same period an introduction to the biological sciences prepares the way for a dawning realization of the relationship of dental restorations of all kinds to a biologic function.

Even though all these threads must be united to eventually develop the dentist who can diagnose, plan, and operate, I believe that we have found the basis of knowledge to be so broad that we must emphasize only part of it at a time.

We seem to have agreed that crown and bridge preclinical emphasis must be placed upon giving the student a knowledge of the accepted methods of constructing tooth-bearing appliances, and by drilling him

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[1]Presented to the Section on Crown and Bridge Prosthesis, American Association of Dental Schools, French Lick Springs, Indiana, 1951.

[2]Professor and Chairman, Crown and Bridge Prosthesis, School of Dentistry, University of Pittsburgh.

in the familiar typodont technic work, developing his skills in addition to his knowledge. Lectures and textbooks alone would acquaint him with the various appliances used to restore partially edentulous mouths; but by having each student complete the so-called crown and bridge technic course, we are agreed that he is best prepared to start clinical work. About 15 years ago, the curriculum survey committee of this association, recognizing the fact that this same situation in operative dentistry, partial and full denture prosthesis, and orthodontics, combined to require so many technic hours that a problem of time and length of the course only could result. This committee recommended that we make every effort to confine preclinical technic work to a minimum of fundamental operations. They set up a series of exercises in crown and bridge prosthesis which combined to make up a "hybrid" bridge with no practical application in itself. They made similar suggestions in other preclinical departments, most of which have been followed.

However, we in crown and bridge do not seem to have followed their wishes. Apparently we feel that a large amount of personal work training is needed in our type of restorative dentistry. A study of our typodonts show that we are in almost unanimous agreement that all the fundamental types of fixed abutments and pontics must be included in preclinical training. Some of us go further, and include simple types of removable tooth-bearing appliances of the unilateral types. Others include certain restorations in ceramics, which in a few schools is taught as a separate course. The fact that all or most schools are following this trend seems to prove that it is necessary.

All of this laboratory work must be accompanied by lectures or seminar instruction which will explain the various technic operations, point backward to a review of the knowledge gained before and now being used, and also keep before the student a vision of the end in view, that is the clinical work, in school and in the dental office. Analysis of this preclinical course, with a full realization that similar courses are being pursued in the other branches of restorative dentistry, points up now as it did 15 years ago, one of the problems of dental education, the great number of hours spent in this work. Even with all our efforts, and the great amount of student time used, we are still not entirely satisfied with the result we obtain; and in spite of efforts to shorten the time and to do away with repetition of certain exercises, our conferences on preclinical teaching seem to have proved that the present group of teachers, you and I, do not see how to do it.

Our recent conferences have placed little emphasis on the biological

problems involved, although at least one paper, Dr. Claude Baker's, dealt with this problem. Apparently we feel that this important phase is better left to the period of clinical teaching. I cannot remember that we have said much about student reading and study, although I am sure we all realize that the student must be active mentally, and that all his knowledge cannot be obtained in the laboratory and classroom. I will deal with this point in considering clinical teaching.

At this point I call your attention to the fact that we seem to still agree that it is necessary to complete a course in preclinical work, then take a second period of time for the clinical. Is it possible that tradition has the better of us? Is there sound reason for not in some degree at least carrying on the two simultaneously?

The objectives of a clinical course in crown and bridge prosthesis can be stated quite briefly. A student who has completed this study in the undergraduate course should:

1. Be able to devise and execute methods of restoration for teeth which cannot be cared for by the methods usually taught in the so-called course in operative dentistry.
2. Be able to plan by visual examination of the mouth, vitality tests, radiographs, and with aid of study models, a suitable method of treatment for partially edentulous cases.
3. When this method of treatment calls for the making of a tooth-bearing appliance, to have the necessary skill and confidence to proceed with its construction.

We see once more that the various threads of the student's study in operative dentistry, full and partial denture prosthesis and crown and bridgework, must be correlated during his clinical years. He must be shown that these divisions are somewhat arbitrary, in many ways overlapping, and that they combine to make up the study of restorative dentistry. Principles learned in one are constantly used in another. Take the problem of occlusion as an example. It is involved in every arbitrary course named, also in orthodontia and in periodontia. We are developing dentists, not crown and bridge specialists.

It is not expected, however, that the student will, prior to graduation, be proficient in dealing with all the intricate problems of abnormal cases. To quote partially from a report of the curriculum survey committee, when a student has completed his study of partial denture prosthesis, he should be able:

1. "To make a thorough examination and a prognosis of a partially edentulous mouth.
2. "To determine the advisability of surgical treatment when needed as an aid in providing the most satisfactory restoration.
3. "To determine the general type of prosthetic restoration needed for a partially

edentulous case, either independently or in conjunction with other types of dental service.

4. "To provide patients with crowns and partial dentures in the planning of which there has been a proper consideration and correlation of mechanical and biological principles, so that the function, esthetic appearance, and comfort of the patient are adequately restored.
5. "To correct and repair prosthetic appliances in service.
6. "To appreciate the limitations of both his knowledge of the subject, and his effectiveness in rendering the service.
7. "To understand the historical development of the principles and practices which constitute his knowledge and skill.
8. "To evaluate new equipment and practices on a rational basis."

This statement of objectives is a real challenge to the student and to his teacher, and gives us an opportunity to evaluate ourselves and our ability to help in its achievement.

In preclinical teaching, we use the laboratory, the lecture, study, and the seminar; but in clinical we add possibly the most important phase of the student's experience, chairside instruction. Up to now, the typodont has served sometimes as the patient, and at times as a laboratory cast. No matter what device we have tried to simulate mouth conditions, it is my experience that the student feels his lack of experience in facing his first patient in partial denture work, or in crown work. He has heard in lecture about diagnosis and planning, chair position, his position in operating, finger rests, care of soft tissues, visibility of posterior teeth, and all the other interesting points about transition to mouth work. He has seen movies, he has watched seniors and demonstrators, but he knows that he is faced with a new personal experience. Fortunately, it is usual infirmary practice to give the student considerable clinical experience in other clinical departments before assigning him to crown and bridgework. This gives him confidence before starting either involved coronal restorations, fixed, or removable partial dentures. In a similar way, he should work gradually into his clinical experience inside the crown and bridge department. In most of our schools, he is at some point in his junior year. Whether it is the school plan to assign patients to students as in a general practice, or to assign students to a department for a period of time, the first assignment of a student can be as a chair assistant to a senior. I do not believe this should be continued for a long period. The student has been longing for chair or practical work. After trying other methods, we at our school have decided that he should have his own cases assigned as early as possible. He should be guided and helped through the first case very carefully. He is usually ex-

perienced enough in other clinical work to take care of the record work until he reaches the stage of treatment planning. At this point the teacher should help him make his first clinical examination, point out all the factors that will aid him in his treatment plan. He should guide him in assembling his radiographs, vitality tests, and study models; and discuss the entire case until a decision on treatment is made. This will really be the instructor's decision, but can seem to be the student's.

Operative procedures in crown work and fixed bridgework should receive the same handling. An instructor should never have supervision over so many clinical cases that he does not have time to do all of the key operating himself as a sort of personal clinic at every situation where a student is faced with his first operation of any type. How much or how little the instructor shall do will depend on the type of work and his conception of the ability and confidence of the student in the particular point at issue. Chairside instruction, the most important part of fixed bridge teaching and of removable work of the precision type, is such a variable that we cannot possibly cover all the situations that may arise. However, the instructor must know, or be able quickly to recognize the ability of his student, and he must be qualified to meet emergencies of operating that are sometimes quite involved by student errors. There is not time or are there often patients sufficient to allow of a long apprenticeship in this or any other clinical work. If the student has been well prepared, and is himself the adaptable person he should be, one demonstration of a few of his first operations and a few corrections of his errors, should soon make it possible for him to overcome the difference between technic laboratory work and mouth work. Soon the instructor finds that he can observe, make constructive comments, and bring most students to the point where they have the confidence necessary to allow of their own diagnosis, planning, also carry the whole case to completion. I do not need to tell this group of the pleasure to be found in demonstrating clinical bridgework. A good instructor in this work is not spectacular, but effaces himself. He usually little realizes that his attitude and ability helps inspire students so that the whole level of dentistry is lifted. If there were enough men of the type I visualize, we would need no other methods in our clinical work. The apprenticeship method, at its best, is the ideal way to teach clinical dentistry.

I saw very recently a TV incident which comes to my mind. Richard Rodgers, the song writer, was being honored by his friends. At the close of a fine rendering of many of his songs, he was presented with

a little gift. Rodgers' response was, "This is a peculiar business. For years you are allowed to do something that you must do, else you would die. Then you find they pay you for it, and even honor you for doing it."

This same relationship between instructor and student should cover the laboratory operations involved in the construction of the appliance. If at all possible, a separate clinical laboratory for clinical crown and bridgework should be situated near to the clinic. The student, having completed his preclinical work, feels at home here, but should have general supervision and constructive criticism. Every member of the departmental staff should serve in this work; but some of us are particularly adept at it and interested in it. Occasionally an experienced technician can be used in this part of the apprenticeship system.

While apprenticeship is the center of clinical experience in crown and bridgework, it should be surrounded by other methods, some intended to give the student better understanding, others to inspire him. Many dental students, interested as they should be in their daily clinical experiences, find so much to absorb, that they feel their work is done after a day in the clinic. They feel that they have spent enough time in book study and in reading in their preclinical years. This belief has led to one of the criticisms of dental education and of dentistry itself, as a non-reading profession. I have found, however, that the serious minded student will respond to a suggestion in this matter to the point where he reads beyond his present experience, and in the clinic becomes a superior student.

At the very least, a regular routine of study should require every student to set aside time to plan his next day's clinical work. If he knows, for example, that he will prepare an upper molar for a bridge abutment, he should review his textbook, his notes, so that he is prepared mentally to start to work. He knows his instrumentation, his routine, and his objectives. Later on, perhaps, he can operate well without previous thought, but I doubt it very much. (With thirty-some years of experience, I still can not do it and be satisfied.) Then a second period of time should be set aside to consider the variations noted during the clinical operation previously done. Very few cases follow the text in exact measure. To put these variables in writing, is to make valuable footnotes for future references; and this type of practice will open the door to reading of the literature on similar subjects. This matter of study and reading is an important one in all phases of dental life during the clinical years.

To leave the student here to absorb information from clinical con-

tacts, to develop skills from continued operation, and to study on his own behalf, does not quite complete the picture. Three other means are needed to pick up loose ends and to prepare him to get ready for graduation. One of them is the seminar, the second group clinics, the third is the advanced lecture. The seminar gives him an opportunity for self expression, for comparing notes with the various members of the crown and bridge staff, who should take turns in conducting this type of conference, and with other students. The seminar, which can be arranged so that comparatively small groups can take part, also paves the way for showing the need of membership in study clubs after graduation.

The lectures for clinical students should be of both educational and inspirational nature. They should be given largely by staff members, and should cover procedures which cannot be constructed in undergraduate years. Selected guest lecturers should be brought before the class to present subjects which will give emphasis to fundamentals or bring new and interesting procedures to the attention of the students.

Dentistry is a profession which treats a very narrow field; but, on account of the nature of the special tissues in that field, the natural changes in those tissues from the cradle to the grave, and their peculiar pathology, a field which needs a broad approach. In teaching crown and bridgework, an unusual opportunity is found to emphasize this fact. With the exception of surgery, every attribute of a successful dentist is developed in our field. The physician of the mouth, the artist, the precise mechanic, the engineer, the inspector, are all found in the successful crown and bridge worker. If the student gets the vision of this, and develops the necessary aptitudes, he will demonstrate it in studying crown and bridgework. Gentlemen, we have a real responsibility in our attempt to serve as teachers of this subject.

Discussion

PAUL E. WESTON, Ph.D., D.D.S.,[1] *Memphis*

Dr. Young has given us an excellent résumé of the previous annual discussions of the preclinical or laboratory course in fixed bridgework, covering the aptitude of the student, the material to be included in the course, and methods of teaching. He has also brought out the need for education in the arts and biological sciences, a field which is so important but often considered too lightly. Dr. Young's generalized

[1]Professor and Chief of the Division, College of Dentistry, University of Tennessee.

presentation of the clinical problem is intended, of course, as an outline and an aid in provoking discussion; this I believe he has done quite well.

As I see it, the problem is to produce the best educated dentists in the shortest time and at the least expense, not only to the college, but also to the student. This was brought forcibly to my attention while I was designing our new dental building in Memphis. Size of classrooms, laboratories and clinics is bound tightly to the curriculum being taught and the staff available. A laboratory class, for example, must not be too large for one instructor to handle efficiently nor to small to employ two without undue extravagance. Waste in the form of excessive corridors, awe-inspiring stairways and classrooms which are half-filled and occupied only two or three hours per day must be avoided. This can be done and still have a beautiful structure.

Likewise in our clinical teaching there must be a way to educate students so they will become capable dentists in the least time and with the fewest instructors. Our aim should be to teach fundamentals. We do not need to teach our students a great number of ways to build bridges; let us teach a few fundamental ways and train the student to perform operations in a patient's mouth. Once he learns to operate in the mouth he will be able to construct any type of restoration a case may require, and after graduation he can expand his technical and diagnostic abilities of his own volition while he is conducting his practice.

The plan which Dr. Young calls the "apprentice system" is ideal provided the instructor is well educated and capable; but how many of such instructors can you find? It is bound to be expensive. To improve the system we must make it possible for the "master" to educate more "apprentices." This can be done by analyzing the course into its fundamental unit processes, or unit operations, and teaching or integrating them into a whole. Assistants, who need not be so capable as the "master," and who command a lower salary, can be employed to teach the unit operations under the direction of the "master." The assistants must learn to "work in harness" and the Chief of the Division must be a "teacher of teachers." Incidentally, the replacement of instructors is also a less serious problem under this plan.

As a unit operation let me take as an example the preparation of a molar for a complete veneer cast gold crown—certainly a fundamental and essential procedure. There are several ways of going about this, but let us have a staff meeting, discuss the various ways, agree on one and proceed to teach it (unless, of course, some unforeseen situation requires its modification). By doing this we can prescribe an arma-

mentarium, listing each instrument in order and its function. Make it look simple to the student and encourage him; if you do not, he will have the bracket table piled high with instruments, none of which seems to fit the case, and confusion and discouragement follow. The student already has received this instruction and it is in his notebook—but will he look in his notes before he tackles the case? He does not wish to display his ignorance by looking in the book in the presence of the patient—and time is pressing! An index card can be prepared entitled "Full Crown Preparation." List the instruments on the card, drawing a sketch of stones, etc. This card is not evident to the patient and is easy for the student to carry and consult. I encourage the student to prepare such cards, explaining that he will employ an assistant after he graduates and, in this way, with but brief training the assistant will be able to hand the dentist the proper instruments in the correct order, thus making for speed, more patients treated and a larger income.

A few typical unit operations are: (1) setting the bracket table; (2) local anesthesia; (3) complete veneer crown preparation; (4) cement base; (5) temporary covers, etc. If you examine this system carefully, you will discover that the number of unit operations is not very large.

Perhaps you object to this as "spoon-feeding" and leading toward the development of helpless automatons, but I believe that making the first few steps appear simple will encourage the student and enable us in the end to graduate better trained dentists in less time, which is our goal.

Let us consider this question: When has a student reached the stage of proficiency required for graduation? Should he prepare, for example, six crown and four pontics, or fifteen, or thirty? Would some students not be more proficient after preparing a three-unit bridge than others after preparing thirty units? One of the requirements of a Doctor of Philosophy degree is that the candidate have a reading knowledge of German and French. Courses of instruction are available, but merely passing the course is not sufficient; the candidate must take a personal examination and he reads and passes or he stumbles and studies more German and French. When he feels capable of another trial he may arrange an appointment and be examined again. In other words, the student must demonstrate satisfactory proficiency regardless of the time required.

We can have practical examinations in clinical bridgework. A minimum amount of work could be set up as a prerequisite, for example, ten units, including two complete crowns, two three-quarter crowns, two New Hue Pin Pontics, two Trupontics, and one porcelain-faced crown

(which counts as two units). If the student wishes to complete more work before he elects to be examined, let him do so. If he fails in the examination he should be required to complete a certain number of additional units before he can be examined again; if he passes he should be permitted, but not required, to pursue advanced work or special cases. The examination could be the preparation of a three-quarter crown on any tooth he presents, and the examiners should be strict.

This system would eliminate the feeling that each student is required to earn a certain amount of money for the clinic by doing a prescribed amount of work regardless of his proficiency, or that he should be graduated because he did the prescribed minimum amount of work regardless of its quality. Having three instructors conduct the examination would prevent students seeking the "high graders" when having work checked and graded, and avoiding the "tough" instructor. The prospect of reducing the total clinical hours by learning to do acceptable operations in less time would spur the students on to greater effort and so enable us to educate more dentists with the clinical facilities and staff available.

Dr. Young has mentioned the idea of conducting the clinical and preclinical teaching simultaneously. I believe he means, for example, that he would train a student in the preparation of a complete veneer gold crown on a posterior tooth, and as soon as the student has demonstrated adequate proficiency assign him a patient who needed this specific operation performed. This seems to me to be an excellent idea, but I see many difficulties, not insurmountable, but contrary to my plan of educating as many dentists as possible at the least expense and in the shortest time. To mention only one problem, consider the classification and distribution of patients, and the completion of operations left unfinished by the student who was not trained in the succeeding steps.

A modification of the plan would be as follows. Let the student complete the preclinical course in its entirety, and be assigned a patient in the clinic. Let us assume that a bridge is to be constructed replacing an upper first molar. The diagnosis calls for a complete veneer cast gold crown on the second molar, a three-quarter crown of a certain type on the bicuspid, and the use of a Trupontic. The student could be required to prepare an equivalent extracted tooth, or an artificial ivorine tooth, of each type, using the armamentarium required in the mouth, before he is permitted to operate on the patient. This preliminary training would refresh the student's memory of the technic course he had six months or more ago, and I believe it would reduce the number of units

required in the clinic to achieve adequate proficiency for graduation.

Clinical demonstrations by an instructor are indeed desirable. I wish to state only that the group should be small enough (e.g., only four) so that the students can really see the demonstration, and that I think two demonstrations would be better—one before the student does any clinical operating at all and a second after he has struggled awhile and has come to realize the difficulties encountered. During the demonstration would be a good time to have the student prepare a list of the armamentarium; he could submit it for approval with his written report of the demonstration.

The relation of crown and bridgework to other divisions of clinical teaching is extremely important, not only for the reason given by Dr. Young, namely, that "we are developing dentists, not crown and bridge specialists," but also to develop cooperation between the divisions by arriving at a diagnosis before beginning the restorative work. Of course, we must allow that our diagnosis is tentative and subject to modification as the operating progresses, but a completed diagnosis card for each case, approved by all divisions concerned, impresses upon the student that the mouth is to be considered as a whole, and further as part of a larger biological system, and not merely as a container of individual teeth, each self-sufficient and independent of the others.

This consideration of the oral cavity as a whole and its relation to the entire body is also emphasized by having each student prepare an approved diagnosis and treatment plan and carry the restoration and treatment to a conclusion. During the progress of the work study models are prepared and photographs made which are later used in a seminar. The seminar covers all phases of dentistry, not only bridgework, and the etiology and scientific basis of our treatment are discussed. In this way the final and most important objective is achieved—the biomechanical aspect of the problem, and the fact that our bridges are not mere engineering structures, but the end result in the successful treatment of a diseased, living organism.

CORRELATING THE TEACHING OF PRECLINICAL AND CLINICAL CROWN AND BRIDGE PROSTHESIS[1]

J. RAYMOND GILL, D.D.S.,[2] *San Francisco*

What is the objective of crown and bridge prosthesis? The objective of crown and bridge prosthesis is to reestablish lost function and health to the mouth in order to prevent further degeneration of teeth and supporting structure. The purpose of preclinical crown and bridge is to teach the student the fundamentals of crown and bridge prosthesis.

In order to more clearly bring out the principles of crown and bridge, it is essential that we include in our didactic courses some of the fundamentals of masticatory function relative to the equilibrium of forces and protection of the soft and hard tissue. In our technical courses, exercises should be done on models that simulate more or less ideal conditions. We may classify the principles of crown and bridge prosthesis as follows: (1) Anatomy of the teeth; (2) cavity preparations; (3) adaptation of band and methods of taking impressions; (4) adaptation and handling of wax and reproducing anatomical function; (5) investing and casting; (6) construction of the pontic; (7) rigid and non rigid connectors.

It is imperative that the student study the anatomy of each individual tooth previous to starting his preparation. In this way, he can visualize: (1) How he should make each cut in order to obtain maximum resistance form with the minimum amount of tooth destruction; (2) the occlusal anatomy, so that he can remove a uniform amount of tooth structure and follow out the occlusal architectural design so that he can reproduce and obtain occlusal function. He must visualize the type and position of retention that is indicated for each type of preparation. The technic exercises in the preparations and retainers should be sufficient enough of a variety to give the student experience in more than one or two types. This will prepare him more adequately for the clinic. He must also understand his instrumentation before starting his preparation so that he will know his best approach with each instrument.

It is important that students are taught how to contour and festoon the impression band so that an accurate impression can be obtained. It must be implicitly impressed upon the student that an impression should be an exact counterpart of the preparation, otherwise, all fol-

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[1]Presented to the Section on Crown and Bridge Prosthesis, American Association of Dental Schools, French Lick Springs, Indiana, 1951.

[2]Professor and Chairman, Division of Crown and Bridge Prosthesis, College of Dentistry, University of California.

lowing steps in the construction of the retainer will be a failure. The impression band should be prepared to accept the type of impression material that is to be used. The student should be taught the correct handling of the impression material that is best adaptable for each individual type of preparation. It is my belief, that a student should have the privilege of using the various types of impression materials that are available and be given instruction in their use. Teachers are more or less prone to discuss and put emphasis on the impression material that they prefer. Each teacher should be acquainted with the handling of all impression materials available. Also, the student should be taught the various methods of making dies and their indications and contra indications.

The construction of a wax pattern in crown and bridge prosthesis involves greater technical skill than that in any other part of dentistry. In most cases the student must include the entire anatomical form of the tooth or the greater part thereof. He must understand and use in principle, tooth morphology, applied dental anatomy and gnathodynamics in the construction of his wax pattern. It is my belief that the student should be taught the burnished coping and also the cast coping. This should be included in one part of his exercises.

In the dental materials course the student is taught the principles of investing and casting, the greater part of the instruction being in the didactic. The time allocated for a course in dental materials is not sufficient to permit them to require the student to employ various methods of investing and casting. Therefore, each division in their technical courses should give the student the opportunity of using the hygroscopic method of investing and wax elimination, the thermal expansion technic and the wax expansion technic. In casting, they should have the privilege of using the centrifugal casting machine, air pressure casting and the thermal casting.

In the construction of a pontic in our technic, exercises should be set up so that we may diversify the type of pontic to be constructed. It is not possible in any technical course to cover all the various types of pontics. Therefore, in our didactic, the course in pontic construction should be comprehensive. It is possible in the technic to demonstrate the various types of pontic construction by having certain groups of students vary their type of pontic construction. This will give the entire class some idea, at least, of the construction and indication of these pontics. At this time, also, the students should be instructed in the method of reglazing the porcelain pontic that has been ground, the

application and the firing of the surface glaze, which requires considerable care, and the construction of a pontic, and porcelain tip on a facing. Students should be given lectures in their didactic course on the principles of ceramics, the method of condensation of the porcelain tip and its pyro-chemical reactions during the firing of the porcelain, the reglazing of the facing or pontic, the time temperature and the range of firing which is extremely important.

In the use of connectors, we have two types: rigid connectors and non rigid connectors. With rigid connectors, it has been our experience that depending entirely upon solder is one of the weaknesses in our technic. We have modified this by cutting a recess in the marginal ridge on the surface adjacent to the space to receive part of the casting of the pontic. When this is soldered it makes a stronger and more dependable connector. The loose end or non rigid connectors may be made by cutting a dove tail of sufficient length gingival occlusally into the retainer, then while constructing the wax pontic, the wax pattern of the dove tail is made and attached to the wax pontic. Another method is to employ the use of a recess former in the wax pattern, casting the retainer and dissolving the recess former out. Our connector then is made from the wax pattern of the recess former which is connected to the wax pontic. Still another procedure is to use the precision attachment, soldering the female attachment into one of the retainers and then soldering the male portion into the pontic.

It is our belief that the student should get some instruction in the use of precision attachments. We have, therefore, set up in our technical courses the construction of a fixed removable bridge. We employ the precision attachment as one connector of the bridge. The other connector is made by using a recess former, which is inserted in the wax pattern, invested and dissolved out after casting. A wax pattern is then made in the recess and then attached to the wax pontic and after casting can be employed as either a semi-rigid or non rigid connector. The posterior connector, or precision attachment, is locked into position with a screw, either from the lingual, buccal or occlusal depending upon the easiest access.

The student should receive a well rounded course in dental ceramics, because in all of his bridge work, porcelain is used to some extent. The construction of the porcelain crown is an important adjunct to his education in crown and bridge prosthesis. The porcelain crown teaches the student the importance of critical observation. He must know how to select the color of the tooth and its distribution; he

must be taught how to interpret the color and distribution in the construction of the crown; he must be observant in his analysis of the effect fillings and caries have on the color of the tooth. He must chart the distribution and this information will help him in his construction of the pontic by modifying his porcelain pontic to obtain harmonious results. These can be obtained by resurfacing or deep or surface staining. With a comprehensive course in dental ceramics, the student can reproduce a harmonious effect which otherwise would be an incongruous result.

All of these exercises are made on models with ideal relation and are mounted on an anatomical articulator so that the student can employ the principles of occlusion and gnathodynamics. The object of constructing the technical exercises as ideal cases, is to present and teach the students the fundamental principles of crown and bridge prosthesis. To teach him all the variations would only serve to confuse him.

In operative dentistry, after his preclinical technic, the student goes into the clinic and first is given prophylaxis patients. This teaches him the principles of handling the instruments in the mouth, and, also, gives him some experience in clinical dentistry. He is then given patients that have simple types of cavities, such as Class I's and V's, and he is taught the use of the instruments and the instrumentation for these simple cavities. After he has had sufficient experience he is then given more complex cases. In this way, he has been given a progressive course in operative dentistry.

Crown and bridge prosthesis, however, cannot follow this type of transitional course for several reasons. Crown and bridge preparations are much more complex than those in operative dentistry. The same ideal conditions do not prevail in the mouths of crown and bridge patients, therefore, there are not a sufficient number of these cases for each student entering the clinic. Most of the cases that we receive in the crown and bridge division are rather complex, this being due to the loss of one or more teeth and the changes that take place not only to the adjacent teeth of this space, but to the teeth opposing and other teeth in the mouth. Therefore, it is essential that we, who are teaching crown and bridge prosthesis, devote some thought to developing and establishing a course that will correlate the preclinical technic course and the clinical course.

Previously, attempts have been made to correlate preclinical technic and clinical crown and bridge prosthesis by giving group demonstrations. The patient selected was usually one with an anterior bridge, for a

group could observe more closely the procedures in constructing this type of bridge. An instructor demonstrated to the students instrumentation, making of the preparation, construction of the retainers and completion of the bridge. Very seldom was a posterior bridge selected, because it was difficult for the students to see the actual instrumentation and the making of the preparation. Also, the patients selected were usually ones that had more or less ideal relation existing in their mouths. In other words, the students were receiving a duplication of instruction, the exception being that the former was done on the typodont model, the latter done on vital teeth. Furthermore, we were not evaluating their ability to think and reason or their power of observation. Little was actually gained in this type of instruction. There should be a course set up sometime during the life of the student's education in school where in some way he can be analyzed as to his method of thinking and reasoning. I believe that somewhere between the period of his preclinical and clinical courses would be the proper time for this course, the effects of which may influence the student not only in his clinical courses but in his career after graduation.

We have at all times presented the course to the students, then examined him on the knowledge gained from these courses. In other words, we are only examining him on the subject material given. We have at no time attempted to evaluate the student's ingenuity. I am suggesting that in this course we attempt to evaluate what ability the student has to figure out problems on his own initiative. Therefore, we must reverse our methods of teaching by giving him the problem and project it before we present the subject material. In this way we can bring out some of the latent reactions of the student. We also will encourage the student in the process of thinking, reasoning and observing.

There may be several methods of attack to this problem, but we must be careful not to make this course too complex. We must simplify it sufficiently but still maintain the premise set up in attempting to evaluate the student's ability to work out some of the more complex problems that are involved in dentistry.

The student has been given lectures in the principles of crown and bridge prosthesis. During these lectures, from time to time it has been explained to him that variations in the technic and modifications of the principles may be applicable in his clinical practice. Therefore, his experience in preclinical technic work, his didactic courses and the experience gained in operative dentistry should have prepared him for the conditions that may confront him in his clinical practice in crown

and bridge. May I suggest the following proposal for such a course outline:

1. Each student is given a model on which is prepared a certain type of preparation that may be indicated for a retainer in crown and bridge prosthesis. Each student should receive a different model. He is then required to reproduce that preparation in a certain given time. When the piece is completed it should be corrected by an instructor and the student should be shown where he has made his mistakes.
2. The next exercise is to evaluate how observing the student is by reproducing what he has seen. The student is given a plaster model with a preparation already made and is permitted to examine it for three minutes. The model is taken away from him and he reproduces the preparation on the same tooth as the model. Again, with an instructor, the model is examined and the student is shown where and why he has made his mistakes.
3. The third exercise is to divide the class into groups of four and place in their possession an upper and lower study model of an original case from the clinic. They are then requested to discuss and outline the procedure in rehabilitating lost function. Each one writes up his own analysis of the case, what he would do and the reasons therefor. He is then requested to select one of the abutment teeth, outline the preparation and write up the instrumentation that he would use in making the preparation he has selected. He would then prepare the type of preparation that he has suggested be used for that individual condition. In this way, each student will have a separate preparation to make but he would gain knowledge through consultation with the other three students in his group. This will teach him clinical observation and an approach to thinking and reasoning.

We may also work out a series of questions for students, whereby we can further evaluate their power of observation and reasoning. This questionnaire should consist of some questions on visual evaluation by them and size and form of various objects and the methods of reproducing certain photographic illusions. How many cases have we seen where dentists have tried to reproduce certain abnormal conditions in an attempt to establish an ideal relation and have not considered the problem of function? This is especially true in anterior restorations where either this or other conditions prevail, where the teeth are rotated and an attempted restoration is made in more or less ideal alignment. In this way the anatomical form of the restoration has been altered, the tooth has been decreased in size, which will make it appear longer; the esthetic results are not harmonious.

The opposite of this is the attempt to fill a wider space without altering the anatomical surface to produce the illusion of narrowness.

Various other questions may be proposed for use in this questionnaire. This idea was approached to me just recently and I believe that it is a good way in which to evaluate the students' ability to observe and reason.

It is stated above that we reverse the procedure of teaching by giving the student this form of courses previous to his didactic instruction. We then follow this with the didactic instruction, placing the greatest emphasis on their ability of thinking and reasoning, the importance to them of being observant in all cases and making every attempt to evaluate each case individually, to restore function and maintain health for the greatest expectancy possible. I believe such a course could be of a great advantage in our undergraduate teaching and I also believe that it should come in at such a time that the student will benefit by future experience.

In conclusion it is essential that we teach the students the fundamentals of crown and bridge prosthesis on cases that are ideal. In this way we can better bring out the essential principles on this subject. We must be cognizant of the fact that the student or the general practitioner does not see these cases frequently. Therefore, we are all aware of the fact that a course similar to that suggested above, should be set up to coordinate preclinical technic and clinical practice. The method of teaching the students in groups has not been the most satisfactory. In the past, we have not had a course or any means of evaluating the student's ability to think, reason and observe. By applying a method of evaluating the student ability to think, reason and observe, this suggested outline, or any outline incorporating the above premise can serve as a nucleus for this type of course.

Discussion

JOHN D. ADAMS, B.S., D.D.S.,[1] *St. Louis*

Doctor Gill's paper may be divided into two parts for discussion: First, the contents and teaching methods of preclinical technics, and secondly, the correlation of preclinical and clinical teaching. As teachers of crown and bridge prosthesis (personally, I prefer the word *prosthetics*), we are, for the most part, rather satisfied with the contents of our preclinical technic courses; but it is reasonable to assume that we may not be so well satisfied in correlating the teaching of preclinical and clinical phases of this subject.

For several years this section has been studying preclinical teaching methods and laboratory course contents. There have been variations in both, but that is normal and good for all of us. Time allotment, schedule difficulties, teaching personnel, and provincial tradition enter into this

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variation of preclinical technic. All previous papers presented to this group on this subject revealed serious efforts toward establishing well-rounded and basically sound technic courses. To add to the list, surely the course as taught at the University of California is an excellent one, leaving little if any cause for criticism.

If the teaching methods and content of preclinical technic were the objectives in crown and bridge prosthesis then our section meetings could be disbanded, because we have covered that field in discussion. However, referring to the title of Doctor Gill's paper we have a new and a very serious problem before us; for in order to fulfill the objectives of this field, the student must pass from the preclinical laboratory to the patient in the clinic, where he performs dental services. If we are to carry out our duties as teachers, then this transition must be consistent with good teaching methods, and therein lies the problem of correlating the preclinical laboratory and the clinical practice.

In developing his subject Doctor Gill has suggested certain changes in teaching methods, especially as dental education understands them. It is true that the contents of our courses change from time to time. As new technics are accepted they are placed in the curricula. How much time have we devoted to improving our teaching methods? If we continue to include more and more material in our curricula, then something must give—either we must increase the length of training, or we must change our methods of teaching. In due respect to dental education we should consider the necessity for guidance from personnel trained professionally in the problems of education. Even Doctor Gill suggests that a new course might be organized to analyze the student's method of thinking and reasoning. Where in your present curricula would you place such a course?

In order to evaluate the student's ingenuity Doctor Gill suggests that ". . . we must reverse our methods of teaching by giving him the problem and project it before we present the subject material." Perhaps there is a way to do that in both the preclinical and clinical years.

How can we better project the problem to the freshman student than to project dentistry as we understand it, and to do that we must present the patient to the freshman student. This is not an original suggestion, but one that presents opportunity for discussion. The problem is dentistry, and to study dentistry so that some time in the future the student may practice his profession he must come in contact with the patient. This does no mean that in the first year of his professional education he starts to perform dental operations upon the patient, but he could be introduced to the dental problems. He could follow the growth and

development of the oral cavity from the child to the adult. He could see the effects of the disease of dental caries. He could observe patients who have become "dental cripples" so that they must depend upon dentures and fixed bridges to restore lost function. He might begin to find the answer to the popular preclinical question among students, "Why all this to fill a tooth?"

But to be more specific as far as crown and bridge preclinical teaching is concerned, correlation must start in the laboratory. The laboratory technic course should be so organized that the exercises taught in the laboratory will become actual clinical cases when the student reaches the clinic. Crown and bridge laboratory work must become "a common language," so to speak, so that in the clinic the student learns to speak and understand this "common language" with his instructors. The ideal situation finds the same instructors in both the laboratory and the clinic. Under such a plan the instructor knows the student when he enters the clinic, and the student's problems are much better understood. This plan is followed as closely as possible at Washington University, not only in the crown and bridge department but also in several other departments. Such a plan strengthens the department, and creates good teachers by stimulating interest in teaching. It helps the student during his transition period, and is a major factor in correlating the two divisions.

At Washington University students work with plaster models in the preclinical course. Each student cuts preparations for retainers in plaster teeth before he works on ivorine teeth in his dentoform. Doctor Tylman suggested such a procedure, and we find it a good teaching method. We do not place time limits on such exercises, but we believe that by using a two-diameter tooth instead of an eight-diameter tooth the student acquires a good mental picture of each preparation used in the course.

We do not use models of original clinical cases, but this is a fine suggestion, and such an exercise could be placed in the technic course. However, we are using models for a type of examination. These models are prepared in two-diameter teeth, and are so prepared that one or two errors are purposely made in each preparation. The student is instructed to look for these errors, and is given a time limit to write his answers on paper. After examining one model, he then goes on to the next one until he has finished the examination. The results of the examination are interesting, for there usually are considerable variations in the answers. So far these models have not been used to correlate the teaching of the two divisions, but rather have been used as teaching aids in preclinical technic.

Regardless of how well we plan our preclinical courses, we still must start the student in his clinical training. Of course, that brings forth the question of when should the student start his crown and bridge work in the clinic? For the student at Washington University this transition takes place over a period of time. He will not start his crown and bridge work until sometime in January or even later, but he will have finished several treatment plans, including crown and bridge problems, before he starts any actual work. For example, every patient entering the clinic is treated as a dental problem, not as a prophylactic patient, not as an operative patient, nor as a crown and bridge patient.

The department of dental medicine guides the student in a general treatment plan, but before he can start any dental operations he must discuss with each department involved the proposed treatment for that patient. These plans are recorded in the patient's record, and are approved by each department by signature. After this treatment planning has been finished, the student is ready to work. This procedure is not carried out in a special department or by special instructors. The student works at his unit on the clinic floor, and any instructor in a department can work with the treatment plan concerning that particular department of which the instructor is a member. The new junior student, therefore, must go through as complete a treatment plan for his first patient as he does for his last patient in the senior year.

As the young junior student develops the treatment plan for each patient, he comes in contact with many crown and bridge problems. He may make study models if he wishes, or he may be instructed to do so. To complete the treatment plan he must discuss in detail with his instructor the crown and bridge problems involved. His background for this work comes first from his preclinical training in the sophomore year, which includes a didactic course and laboratory training; and secondly, from a didactic course in the first two quarters of the junior year, which also includes clinical problems. By using the treatment plan in teaching and by placing the junior lectures at the beginning of the junior year, we believe that we are attempting to correlate the two divisions.

In the past, tradition, to a great extent, has guided us in establishing curricula, but we are gradually seeing changes taking place with new methods in teaching coming forward. Doctor Gill has presented a new approach to one of our important problems. His paper provides us with specific suggestions for additions and changes in curricula. It also opens the opportunity for a most fruitful discussion of correlating the teaching of preclinical and clinical crown and bridge prosthesis.

THE PHARMACOLOGIST AND THE ORAL SURGEON[1]

SIDNEY EPSTEIN, D.D.S.,[2] *San Francisco*

Today, the entire approach of the surgeon has been markedly altered by the broad field of pharmacology, the science of drugs. Chemotherapy has made it possible to perform corrective, repairative, and restorative procedures that are limited only by one's ingenuity and dexterity. The surgeon too often attributes his achievements and proficiency to his knowledge of anatomy, digital skill and keen judgment. He frequently overlooks the amazing recuperative and repairative capacity of the animal body, especially when it can be reinforced and supported by administration of blood fractions and antibiotics.

It is in great measure the contributions of the pharmacologist that have made it possible for the surgeon to add to the scope of his activities. Safe anesthetics, control of pain, the prevention and elimination of sepsis, the supplying of essential electrolytes for maintaining physiologic balance and repair have been the primary problems of the pharmacologist. Without the solution of these factors surgery would be limited in degree and success. Developments in the realm of pharmacology have brought forth drugs that have reduced the necessity for extensive surgical interference. Where use can be made of the newer pharmaceuticals, incisions for drainage, packing of wounds with inert substances or the placing of tubes are no longer routine procedures

The intelligent use of drugs requires that the surgeon must have knowledge of their chemistry, anticipated physiological response as well as methods of use. The day of empirical use of drugs is rapidly coming to an end. Rational for use now must be based on known physiologic response. Oral surgeons have often in the past too readily accepted a drug and since, in a measure it worked, it was accepted and taught as routine procedure.

Consider a few of the factors that may require some new evaluation. One can start almost anywhere. Personal surgical cleanliness may be the starting point. How much confidence is placed in soap and water in preparing oneself as a surgeon? How many rely on 70 per cent alcohol to complete disinfecting their hands when it is actually only moderately effective? Greater effect is achieved by routine use of

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[1]Presented before Section on Oral Surgery, American Association of Dental Schools annual meeting, French Lick Springs, Ind., April, 1951.

[2]Research Associate, Department Physiological Sciences, College of Physicians and Surgeons, San Francisco, Calif.

detergent soaps that contain hexachlorothene.[3] This efficient antiseptic adds to the cleansing action of soap a pronounced bactericidal and cumulative bacteriostatic effect even in high dilutions. Such soaps (example, Gamophen R) because of powerful anti-bacterial action and lack of sensitizing or irritating properties, are useful for those who must scrub their hands many times a day.[4,5] These investigators demonstrated a persistent reduction in the resident bacteria of the human skin occurs when this soap containing hexachlorophene is used routinely and that an individual using such a soap regularly has a lower resident count after two minutes of washing than an individual who washes for twenty minutes with ordinary soap. The daily use of a soap containing hexachlorophene would enable a surgeon to maintain an extremely low resident bacterial population on his skin and offer the possibility of shortening the routine pre-operative scrub up procedures with the elimination of use of irritating germicides without sacrificing skin cleanliness.[6] Studies have been presented that indicate that the use of a bar soap containing 2 per cent hexachlorophene for three minutes without a brush was superior to the routine two brush, ten minute surgical scrub.

The subject of anesthetics may be next in order. Since the days of Wells and Morton, nitrous oxide has been used as the general anesthetic of choice in minor surgical procedures. Nitrous oxide began with dental surgery and has been developed and perpetuated as the general anesthetic most widely used for routine short dental operations. Techniques of administration have varied however. Oxygen-nitrous oxide concentrations fluctuate more from anesthetist to anesthetist than from patient to patient. Descriptions of nitrous oxide anesthesia are always concerned with immediate effect. The dentist who uses nitrous oxide seldom, if ever, considers the physiologic effects of the anoxia produced during the period of anesthesia. He loses sight of the fact that it is the lack of saturation of the red cells with oxygen and the subsequent deprivation of the vital sensory areas of the brain of critical oxygen that causes loss of consciousness. With inadequate oxygen tension, there is insufficient oxygenation of the hemoglobin due to the marked

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[3]Accepted by the Council on Pharmacy and Chemistry of the American Medical Association as the generic term for dihydroxyhexachlorodiphenyl methane.

[4]Traub, E. F., Newhall, C. A., and Fuller, J. R.: The Value of a New Compound Used in Soap to Reduce Bacterial Flora of the Human Skin, *Journal Surgery, Gynecology and Obstetrics*, 79, 203; 1944.

[5]Traub, E. F., Newhall, C. A., and Fuller, J. R.: New Cutaneous Bactericidal Agent Used in Soap—Further Practical Study, *Archives, Dermatology and Syphilology*, 62, 385; Nov., 1945.

[6]Nungester, W. J., Thirlbyrl and Vial, A. B.: Evaluation of Hexachlorophene and Detergents as Substitutes for the Surgical Scrub—A Biological Technique, *Journal Surgery, Gynecology and Obstetrics*, 88, 639; May, 1949.

dilution of oxygen by the nitrous oxide. The oxygen requirements of certain cerebral areas is so critical that depletion or complete lack of oxygen for even a short time causes temporary or even permanent damage to the cellular elements of the brain.

I would like to quote at length from a paper by Barach and Rovenstine:[7]

"The morbidity and mortality following the use of nitrous oxide for surgical anesthesia have increased despite the refinements of administration and the more modern techniques—with higher incidence today than at any time during the century of its use. The 'safest of all anesthetics' in 1900 has become one of the most, if not the most dangerous today. . . . Anesthetists will admit readily that the deaths following anesthesia are most often due to technical errors during the administration or to improper use of the drug in question. This is unreservedly true when nitrous oxide is employed, since the gas itself has not been found to produce a toxic reaction for any tissue.

"The single serious imperfection of nitrous oxide is its lack of potency. When given with a concentration of oxygen found in air, nitrous oxide will not produce a degree of narcosis in many individuals that could be identified as surgical anesthesia. Surgical anesthesia is always predicated on the basis that freedom from pain and muscle relaxation are secured without oxygen want. It follows then, that if nitrous oxide is to fulfill the requirements for surgical anesthesia in a patient who has not received previous depressant drug medication, some degree of anoxia must be an accompaniment. Patients anesthetized with nitrous oxide will always suffer from a severe degree of anoxemia.

"Study of analysis of blood gases show that any appreciable reduction in oxygen below 20 per cent may become extremely dangerous to the patient. In the experiment of McQuiston, Cullen and Cook when the percentage of oxygen in the inspired gases was below 13.7 per cent the arterial oxygen tensions were in the range of extreme anoxia—30 milligrams of mercury. The administration of nitrous oxide is often accompanied by anoxemia. The degree of anesthesia is more dependent upon the reduction of oxygen than upon an increased concentration of nitrous oxide. When patients are properly prepared as in a hospital with sedative and hypnotic drugs, it is not often necessary to administer a mixture of nitrous oxide which contains less than 20 per cent oxygen. However, in the offices of dentists and in the out-patient hospital clinics, this would be unusual practice."

The mortality and morbidity statistics for nitrous oxide oxygen anesthesia in office and clinic practice are difficult to obtain since reports from these sources are infrequent and inadequate. Barach and Rovenstine report eleven sudden deaths during anesthesia in New York City offices during a five-year period. They state that while the number is not large, one must not lose sight of the fact that these deaths were preventable and in no instance was the surgical procedure of such magnitude as to require hospitalization or done for a patient whose physical condition merited hospitalization.

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[7]Barach, A. L., and Rovenstine, E. A.: The Hazards of Anoxia During Nitrous Oxide Anesthesia, *Journal Anesthesiology*, 6, 4492461; Sept., 1945.

Nitrous Oxide

Little has been written in the general literature of the lesions produced by anoxia during nitrous oxide anesthesia. The outstanding report on this subject is the monograph of Courville in 1939.[8] We will again quote Barach and Rovenstine's excellent summary of this monograph in which Courville classifies cases with asphyxial manifestations due to nitrous oxide oxygen anesthesia as follows:

"1. Sudden deaths during nitrous oxide anesthesia. Deaths in these instances could be attributed to a pre-existing lethal lesion, to an inter-current lesion independent of the surgical one, to a combination of disease and asphyxia or finally as directly due to the effect of the anesthesia agent itself. In the last group no pathological lesion is found at autopsy to account for sudden death.

"2. Delayed exitus after nitrous oxide-oxygen anesthesia. These patients may survive for hours or months. The anoxia produced in these individuals during anesthesia 'initiated a process that progresses until a situation is reached that is incompatible with life.' Courville cites numerous tragic cases of decerebration.

"3. The third group with serious morbidity due to the anesthetic agent are those individuals who recover but are left with residual mental symptoms indicating cortical nervous system damage. These patients may present few clinical manifestations of anoxemia during anesthesia. Recovery from narcosis is usually delayed. A mild to severe convulsion may be noticed during the prolonged coma. The residual symptoms may be indicative of cortical or lenticular damage or both.

"4. The final group are those who have transitory mental and emotional manifestations but recover completely. Visual and auditory disturbances, aphasia, convulsive state and delirium are among the complications from which complete recovery has been reported. The consequences of the nitrous oxide anesthesia are due to the accompanying anoxia."

Similar symptoms have been observed in flyers who have been at high altitudes or simulated altitudes with insufficient oxygen. Asphyxia of short duration must be regarded as a great hazard to a great majority of individuals. It must be guarded against to prevent death or permanent impairment in mental function. Nitrous oxide-oxygen anesthesia should not be administered with an oxygen percentage of less than 20 per cent. Even with this safeguard the dangers of asphyxia during nitrous oxide anesthesia are not abolished. Respiratory obstruction always remains a principal cause for asphyxia. Since there is at the moment no device other than that of a mixture of nitrous oxide and oxygen that will insure the provision of 20 per cent oxygen, it is suggested that only such mixtures that are prepared and delivered from a single cylinder should be used in anesthetic procedures.

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[8]Courville, Cyril B.: Untoward Effects of Nitrous Oxide Anesthesia; Mountain View, California Pacific Press Publishing Assn., 1939.

Other Anesthetic Agents

As a substitute for nitrous oxide anesthesia, Feldman suggests the use of *ethylene*, using carbon dioxide 0.25 parts, oxygen 4 parts and ethylene 3.75 parts—in other words, oxygen is 50 per cent of the mixture. He states that the mixture is not explosive if the gas is kept moist and that it does provide ample anesthesia with maximum oxygenation. In order to get deeper anesthesia, he suggests adding a trace of vinethene.

Ethyl chloride should not be used as a general anesthetic. It is extremely toxic and dangerous. It causes cardiac stand-still and respiratory failures. It is very fast acting and if used, should be used only for extremely short procedure.

Ether, while it has unpleasant after effects for the patient, is a desirable anesthetic for long-term procedures. It is nontoxic and comparatively safe. It has a mortality of about one in sixteen thousand cases.

Intravenous anesthesia, despite its widespread use and acceptance, also should be scrutinized carefully. There is a dearth of information as to what is the true rate of mortality—fatalities are usually attributed to something else than the anesthetic agent. Again the question must be raised, does the procedure of intravenous anesthesia justify the risk in routine exodontia? One might ponder the question, are general anesthetics—either inhalation or intravenous—used routinely by many surgeons to cover up their lack of technical skill and proficiency? In all general anesthesia the patient should be given only that minimum quantity of anesthetic agent that is necessary to complete the procedure and permits the patient's return to a conscious state in the shortest possible time.

In the majority of cases careful, intelligent, adequate premedication and correctly administered local anesthetics make it possible to have a more cooperative patient. The surgeon is freed of much tension and anxiety and is allowed a maximum time to proceed.

A word of caution, in intravenous anesthesia with the barbiturates, picrotoxin should not be used as a resuscitant. It is a dangerous drug that may produce convulsions. The only time that its use is justified is when a patient is so loaded up with barbital, as in the instance of a suicide, that it becomes a heroic procedure. When barbital is used as a controlled intravenous anesthetic, the patient does not receive such large quantities. However, when the patient has respiratory failure start artificial respiration and the administration of oxygen immediately. Do not waste time getting analeptics.

There has been some publicity given to sodium succinate to increase

oxygen uptake. The reports have not proved to be valid. In our laboratory a cat was given 10 cc. of 40 per cent sodium succinate, a solution as heavy as syrup. It was repeated at fifteen minute intervals and had no effect on the anesthetized cat. The cat recovered within the normal range of time that one would anticipate.

Local Anesthetic Agents

For most dental procedures, injected solutions of local anesthetics provide most suitable and satisfactory anesthesia. They are most convenient to administer, least toxic and most readily available. There is, however, considerable confusion as to what is the best local anesthetic agent to use. Manufacturers of anesthetic solutions are guilty of constantly confusing the profession with solutions that are essentially modifications of the same substance. All local anesthetic solutions, with one exception, which will be discussed, are derivatives of para-amino-benzoic acid. The principal ones used; procaine, tetracaine, monocaine and butacaine are all essentially the same. Procaine is the least toxic and most widely tolerated. All require the use of vasoconstrictors to impede rapid systemic absorption.

One of the newest local anesthetics to appear on the scene is lidocaine which was a Swedish development that differs from the other para-animo-benzoic acids derivatives in that the NH_2 groups are knocked off, the chain attached to the amino group, and two methyl (CH_3) groups are attached to the benzene ring. Solutions of lidocaine have both topical and local effects. It is more persistent in its action than is procaine and provides for a longer period of anesthesia. It produces more prompt, intense and extensive anesthesia than an equal concentration of procaine. Its anesthetic potency and the area of anesthesia are approximately twice those of procaine hydrochloride when compared in a concentration of 0.5 per cent. The toxicity of lidocaine hydrochloride in mice is the same as procaine hydrochloride, but as the concentration is increased, its toxicity exceeds that of procaine hydrochloride. At 1.0 per cent it is 40 per cent greater, at 2.0 per cent it is 50 per cent greater. It may also be used without epinephrine when vasopressor drugs are contraindicated. The systemic side reaction and local irritant effects are rare. Nausea, vomiting, muscular twitching and chilling have been observed. While it has been employed for topical or surface anesthesia, evidence to support such use is insufficient.[9] No

[9] *New and Non Official Remedies*, 1950, page 59.

vasoconstrictor is necessary when a 2 per cent concentration is used for short procedures.

It is our belief that more consideration should be given to the selection of the local anesthetics used in a given procedure. Not only is there question of the patient's tolerance of the drug but consideration should be given to the duration of time and the depth of anesthesia desired or required. With procaine as our standard as the least toxic and most universally applicable solution, are we justified in using more potent and toxic solutions? The real question of using local anesthetics is more dependent upon the skill in administering the drug and on one's subsequent surgical technique. Potency, onset and duration of anesthesia are the best basis for comparisons. Side reactions can be prevented if only the smallest quantity of the least toxic anesthetic that will produce satisfactory anesthesia is used. It has been claimed that solutions with a pH near that of blood are more efficient and less irritating to the tissue than more acidic ones. Controlled tests have not borne out claims for solutions of pH 7.2 and 5.6 under clinical conditions. Alkaline solutions have not been shown to be superior. Tissue fluids are well buffered and will neutralize the free acid in local anesthetics.[10]

In considering the toxicity of procaine, one constantly hears repeated the dangers of intravenous injection of procaine solution and of the precaution one must take in not permitting it to get directly into the blood stream. Actually the observed untoward effects of intravenous procaine are the results of confusing the injection of procaine per se and procaine epinephrine. Procaine is widely used intravenously for analgesia. It is possible to give in dilutions of 1 to 1000 as much as 4 milligrams per kilo in a twenty-minute period or approximately a gram an hour to a person weighing 60 kilos. Procaine has a salubrious effect in congestive heart failure and acts very much as does quinidine in cardiac arythmia. It is widely used to infiltrate painful areas and to stop obscure headaches. Procaine may also be used as an antidote for over-administration of pentothal especially when pentothal is actually injected into an artery. In event of such an accident very severe pain occurs characteristically in the hands with erythma immediately followed by arrested circulation in the part due to spasms of the terminal arteries. In such instances, thrombosis may occur and amputation of the limb may be necessary. The injection of a few ccs. of 1 per cent procaine causes an immediate dilatation of the vessels and allows the pentothal to be washed away.

[10] *Accepted Dental Remedies*, 1949, pages 41-42.

Topical anesthesia will be mentioned only in passing. There is no real need for such preparations if sharp, fine gauged needles are used with good technique. However, if need persists for a solution, 15 per cent benzocaine in propylene glycol is most effective. Many solutions that are used are very escharotic, and should not be used at all.

Keeping the patient comfortable after operative procedure is also one of the surgeon's major responsibilities. However, there is often great confusion in the use of sedatives and analgesics to enhance well being. Analgesic drugs are used to relieve pain without producing loss of consciousness. The more potent ones have a central analgesic effect which may produce addiction. Sedatives act principally as depressants of the central nervous system and may be used to induce sleep if pain is absent or to control convulsions. Sedatives will not control pain.

Barbiturates

The use of the barbiturates is chiefly for the depression of the central nervous system. The hypnotic effects can vary from light sleep to deep coma, depending upon the size of the dose and the patient's reaction. The proper oral dose should induce sleep in 20 to 60 minutes.[11] Barbiturates are useful in psychic sedation, producing a sound sleep the night before a surgical operation and allay fears before operation. They are valuable and necessary in preventing respiratory failure in an excited child patient before giving it a general anesthetic. Patients should not be given more sedation than necessary. In the use of the longer acting ones, the patient requires watching and should not be dismissed to the street alone.

Barbitals should be given prior to local anesthesia to prevent the excitatory symptoms of acute poisoning due to procaine and butacaine sulphate. Overdoses of barbiturates in sedation can indirectly diminish the secretion of urine. Since urine is the most important avenue for the excretion of these compounds, especially the more stable compounds, the patient's recovery is delayed. Therefore, they should not be given to patients with kidney disfunction because the failure of the kidneys to excrete the barbiturate causes cumulative toxicity.

Sedatives can be safely used in conjunction with analgesics. Always bear in mind, however, that if the drug is being given to control or alleviate pain, the emphasis must be on the type and dosage of the drug used as an analgesic. The degree of sedation desired must be determined separately.

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[11]Goldstein, Samuel W.: Barbiturates—Valuable Therapeutic Agent and Public Health Problem, *J.A.M.*, 35, 370; Sept., 1947.

Analgesic Agents

As Wolff and Wolff[12] point out the management of pain constitutes a serious clinical problem not only because of itself as a distressing experience, but also because pain has been demonstrated to have deleterious action upon such vital organs as the heart[13] and kidneys.[14]

Pain threshold may be defined as the lowest perceptible intensity of pain. As the pain threshold is raised, more stimulus energy is required to induce threshold pain. The ability to perceive pain depends upon the intactness of relatively simple and primitive nerve connection. Reaction to pain, on the other hand, is modified by the highest cognitive function, and depends in part upon what the sensation means to the individual in light of past experience. It has been shown that the intensity of deep pain may be reduced by non-noxious tactile pressure and thermal stimula applied to the skin. This effect doubtless explains the efficacy of hot water bottles and ice bags in various painful conditions. Deep pains characteristically spread to be felt in areas other than those stimulated. The spread may involve deep or superficial pathways or both. This effect has been called referred pain. It is attributable to the spread of excitation in the neuraxis to other portions of the same segment or to segments adjacent to those into which noxious impulses are conducted.

Pain relieving drugs which interrupt the mechanisms responsible for pain must be distinguished from analgesics which modify sensory perception or reaction. Examples of the former are atropine which may relieve the pain of smooth muscle spasms by relieving the spasms and ergotamine which interrupts the mechanisms from migraine headache by constricting over-distended arteries. Neither of these drugs are, strictly speaking, analgesics. The most common drugs with their effect on pain threshold in man are acetylsalicylic acid, acetanilid, acetophenetidin and amidopyrine, which acts primarily on the threshold for pain perception having relatively little effect upon the reception to pain. Each of these drugs has optimal dosage that affords close to maximum pain relieving action. Increasing the amount administered beyond this point does not further raise pain threshold significantly. It prolongs the effect only slightly and accentuates the undesirable side effects. Combination of two analgesic agents do not produce an additive effect, but merely

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[12]Wolff, Harold G., and Wolff, Stewart: Pain; Charles C. Thomas, Publishers, Springfield, Ill., 1948.
[13]Gold, Harry et al.: The Effect of Extra Cardiac Pain on the Heart, *Proc. A. Research Nerve and Mental Diseases*, 23, 345, 1943.
[14]Wolf, George: The Effect of Pain on Renal Function, *Op. Cit.*, 23, 358; 1943.

the effect of the stronger agent. Repeated administration of one agent to keep the threshold high is the most effective way of dealing with pain as far as perception is concerned. The threshold for pain perception may be kept elevated indefinitely by repeated administration of 0.3 gram of acetylsalicylic acid.

Other analgesics, including opiates and alcohol, owe their efficacy to the ability to control reaction to pain as well as raise the threshold for pain perception. The relaxation, apathy and freedom from anxiety which follows administration of morphine, long outlasts its effect on the threshold for pain perception. In the management of a painful condition, it is important to recognize the function of pain as indicator of disease or acute inflammatory process. Most rational therapy for pain involves not the use of analgesics or mutilating surgical procedures, but the interruption of the mechanisms which produce pain. Analgesics are administered only when the latter cannot be satisfactorily accomplished. For the proper choice of analgesics, it is important to obtain some estimate of how long the painful condition is likely to persist. Addiction to morphine and similar drugs frequently follows prolonged use for the relief of chronic pain. It is important to estimate, if possible, how much of the patient's discomfort is due to the perception of pain of noxious stimuli and how much may represent over-reaction to minor disturbances at the end organ.

Antibiotics

The advent about 1942 of the modern era antibiotic has completely altered the approach to prevention and treatment of infections. The need for extensive surgical drainage is no longer a requisite—cellulitis and osteomyelitis respond rapidly to chemotherapy. Correct use of the antibiotics makes it possible for the surgeon to throw out part of his bag of tricks and discard quantities of empirical drugs. This does not mean that surgical interference in infection is no longer necessary. It becomes more a question of when and to what degree.

An antibiotic is defined as a substance that is bio-synthesized by a living organism and that is capable of inhibiting growth otherwise interfering with the metabolic activities of the same or other species of micro-organisms.[15]

From the standpoint of dental infection, the usefulness of *sulfonamides* has been quickly surplanted. There is less frequency of development of resistant strains of bacteria than in treatments with sulfonamide

[15]Pratt, Robertson, and Dufrenoy, Jean: Antibiotics; J. B. Lippincott Co., Philadelphia, 1949.

drugs. There are a considerable percentage of bacterial infections that are not amenable to sulfonamide therapy. Then, too, the usefulness of sulfonamide is limited by the fact that their antibacterial activity is lessened when large numbers of bacteria are present or even when dead bacteria, pus, blood serum or other products generally found in an infected wound are present. For the most part, the new mycotic antibacterial agents do not have these undesirable properties.

The choice of an antibiotic should be made according to the kind of micro-organism responsible for the infection to be treated. Thus if the infection is due to a gram-positive bacteria a penicillin is generally first choice. If the infection is due to a gram-negative organism a form of streptomycin or polymycin is selected. *Aureomycin* or *chloroamphenicol* is used in the treatment of rickettsia and virus infection. This does not imply that there is no cross-activity among antibiotics nor is it meant to imply that a given antibiotic is equally effective against all species of micro-organisms of a given class.

The high selective action of *penicillin* is simultaneously its greatest virtue and the single factor that imposes limitation on its use. The virtual lack of toxicity of penicillin with the tissue of the host (except in a relatively small percentage of the population allergic to it) makes this antibiotic the drug of choice for all infections caused by micro-organisms that are inhibited by concentration of a tenth unit or less per millimeter. Its selectivity of action is limited principally to the gram positive cocci and makes it relatively useless against other important pathogens.

Gram-negative bacteria, acid-fast bacteria, viruses, rickettsia and protozoa are not considered amenable to chemotherapy by penicillin, because the organisms are not inhibited by doses that are practicable to attain and maintain clinically. Exceptions are gonorrhea, a gram-negative cocci and psittacosis, caused by a virus.

The questions of antibiotic spectra, differences of sensitivity and resistance of different strains within a given susceptible species should be decided by isolating the pathogen in pure culture from the patient. The culture should be tested in vitro against the selected antibiotic. Many infections characterized by well defined clinical symptoms can be defined as being due to penicillin sensitive organisms without resorting to preliminary micro-biotic tests.

All antibiotics should be administered systemically to maintain adequate blood level concentration even in the treatment of localized infection. The only exception is the use of tyrothricin which cannot be used other than locally because of its hemolytic action. Even in cases

where the focus of local infection is readily accessible to topical medication, it is advisable to fortify local treatment by building up the blood level through systemic administration.

The threshold concentration that is required for treatment of a specific infection depends primarily on the sensitivity of the pathogens to penicillin or the selected antibiotic. Most infections amenable to penicillin therapy can be successfully treated by maintaining a blood level of 0.03 to 0.05 units (0.02 to 0.03 micrograms) of penicillin per ml. of serum as long as fever persists and for at least 18 to 24 hours thereafter. Penicillin is best administered by intermuscular injection to maintain most effective blood level. However, if it is given orally, five times as much penicillin must be administered to achieve the same blood level as by intermuscular injection.

In the oral administration of penicillin there is no particular difference in concentration over 24 hours in patients receiving it on fasting or nonfasting status. The use of relatively insoluble penicillin or buffered penicillin is not important. The disintegration time, however, of the tablets of penicillin that are used does have a definite effect upon the plasma concentration. It is always well to check tablets used to determine that they are soluble in water.[16]

The literature contains conflicting statements on the effect of penicillin on the clotting time of blood. However, the preponderance of evidence seems to favor the view that normal therapeutic doses of penicillin exert very little if any effect on the clotting time of blood.

Pratt and Dufrenoy state that local application of excessively large doses may delay clotting in the area involved; therefore, the placing of dry penicillin in a tooth socket following extraction should be discouraged. This is contrary to our own extensive observations on the use of pure crystalline G penicillin tablets of 50,000 and 100,000 (Penalev R) units that we have been using as implants routinely for about two and a half years.[17] No delay in the forming of a normal clot has been observed. Postoperative results have been particularly gratifying because of patients' reports of freedom from pain possibly due to the lack of violent inflammatory reaction and attendant edema. The number of septic alveoli has also been statistically insignificant. The rate of tissue repair has been especially noteworthy. Often at the end of three days the tissue has an appearance of being eight or ten days old. These results are in contrast to previously reported studies

[16]Boger, William P., and Beatty, John O.: Procaine Penicillin Administered Orally; Comparison with Sodium Penicillin, *Journal of Investigative Dermatology*, *15*, 373; Nov., 1950.

[17]Epstein, Sydney, and Kauffman, Raymond: Penicillin Tablets in Oral Surgical Procedures, *Journal of Oral Surgery*, *9*, 115; April, 1951.

using the *sulfonamide* and *tyrothricin* thrombin preparations in surgical areas. While *aureomycin* is now recommended in such procedures we have seen no clinical studies reported to date.

Streptomycin is indicated in the treatment of systemic infection caused by sensitive gram-negative and acid-fast, gram-positive bacteria. Its greatest value is in the management of various forms of tuberculosis. Streptomycin does cause serious chronic toxicity. However, the difficulties may be diminished to some extent by properly regulating the dosage and the duration of streptomycin therapy. Dosage varies according to diagnosis and clinical conditions of the patient. The trend is toward smaller doses than used formerly. Favorable therapeutic effect can be obtained and there is less reaction if small doses are given for relatively brief periods.

Chloroamphenicol, aureomycin and terramycin are the newest of the antibiotics.

Chloroamphenicol appears to fufill almost ideally the two fundamental requirements of a chemotherapeutic agent. That is, it is deadly to the disease causing micro-organisms but at the same time harmless to the tissues of the host and cause no detectable ill effects.

Aureomycin is most effective against actively multiplying micro-organisms and exerts relatively little effect against fully grown or metabolicly relatively inactive cultures. No micro-organisms are known at present to inactivate aureomycin and in only a few instances has evidence of resistance appeared following continued or repeated exposures of "sensitive" bacteria. *Aureomycin* is effective both in vitro and in vivo against a variety of pathogenic bacteria but its greatest potential value probably lies in its rickettsicidal activity so this may be superseded by chloromycetin.

Aureomycin has also been reported effective against certain virus infections. It produces no untoward reaction except occasional transient irritation at the site of injection. Oral doses sometimes cause nausea.

Polymyxin is specifically effective against gram-negative micro-organisms. An additional merit of *Polymyxin* is that initially sensitive bacteria do not appear to develop resistance to this antibiotic as they do to a streptomycin. *Polymyxin* has the greatest value in treatment of human infections caused Pseudomononas aeruginosa, Klebsiella pneumoniae, Hemophilus pertussis and by Brucella abortus. Its greatest value is in the Hemophilus pertussis (whooping cough). The most serious obstacle to wider clinical use of *Polymyxin* is its toxicity.

Tyrothricin is the best of the surface active antibiotics. It is effective

against many gram-positive pathogens but because of its hemolytic action is not suitable for systemic chemotherapy. Indiscriminate nasal application may cause irreversible injury to the olfactory nerve.

In general, it may be stated that the dental profession, like other specialties in medicine, have come to rely, possibly too heavily, upon the use of antibiotics. There is a tendency among dentists to administer the drugs first rather than to make a diagnosis. Then, too, their confidence is so great in the antibiotic they do not continue to be alert in subsequent observations. There is also a tendency to use the antibiotics in almost hemopathic dosages. If the antibiotics are to be used and are indicated they should be used wholeheartedly in high doses to secure optimum blood level. It is therapeutically wrong to pepper patients or the disease entity with inadequate amounts. When indicated, the oral surgeon should give prophylactic dosages of penicillin or other appropriate antibiotics at least 24 hours before any surgical procedure and for a sufficient time postoperatively to prevent any untoward result.[18]

The clotting of blood (that is, the transformation of the fibrinogen of circulating blood into the insoluble fibrin of the blood clot) is due to the action of the fibrin ferment (thrombin) of the fibrinogen of the blood. The fibrin ferment of thrombin exists in the blood in the form of its forerunner (prothrombin) which is acted on by the calcium salts converted into *thrombin*. Besides calcium salts, however, another factor is necessary. This other factor may be furnished by the breaking down of blood cells or blood platelets or by injured tissue. These are designated the thromboplastic substance. Preparations containing thromboplastic substance are useful when applied locally in the treatment of hemorrhage, especially hemorrhage from oozing surfaces. Intravenous injection is dangerous and there is no satisfactory evidence that subcutaneous injection is useful. Internal use of these substances is not warranted on account of the danger from anaphylaxis.

Fibrin foam made from citrated normal human plasma acts as a mechanical coagulant and in combination with thrombin serves as a chemical as well as mechanical matrix for coagulation. It is applied directly to the oozing surface. *Thrombin* is a sterile protein substance prepared from the prothrombin of mammalian origin through the intersection with added thromboplastin in the presence of calcium. It accelerates the clotting of blood. It is used as a hemostatic for topical application to control capillary bleeding in operating procedures. It may be applied as a dry powder. It is never to be injected.

[18] *New and Non-Official Remedies*, 1950, page 302.

Tannic acid and ferric chloride are no longer listed as accepted hemostatics.

Absorbable gelatin sponges may be used as hemostatic mechanical controls and may be used to aid in the closure of an operative wound. The material will be completely absorbed from four to six weeks without inducing excessive formation of scar tissue or excessive cellular reaction. In using it to control capillary bleeding it should be moistened with thrombin solution.

Oxidized cellulose or absorbable cotton or gauze is a specially treated form of surgical gauze or cotton that exerts an unusual hemostatic effect and is absorbed when buried in the tissues. Its hemostatic action depends on the formation of an artificial clot by cellulosic acid. This acid has a marked affinity for hemoglobin but does not enter per se into the physiologic mechanism of clotting. Absorbability depends on the size of the implant used and the adequacy of the blood supply to the area and the degree of chemical degradation of the material. Absorption of oxidized cellulose occurs between the second and seventh day following implantation of the dry material. Complete absorption may take six weeks or longer. Hemostatic action of oxidized cellulose is not enhanced by the addition of other hemostatic agents. Thrombin would be destroyed by the low pH of the material and the hemostatic action of either alone is greater than that of the combination. Moistening with water or saline is not recommended, as the hemostatic effect is greater when the dry material is applied.

Oxidized gauze and oxidized cotton should not be used as a surface dressing except for the immediate control of hemorrhage because the cellulosic acid inhibits epithelization.

There are many other equally important subjects such as the use of electrolytes in making up isotonic solution to maintain normal osmatic atmosphere for all the cellular elements necessary for tissue repair and protection; premedication, or drugs used as postoperative dressings. Armed with the fundamental pharmacologic and physiologic concepts of today the surgeon has available pharmaceuticals that greatly aid him to minimize pain, reduce the hazard of infections and alleviate in a great measure the mental and physical stress that accompanies disease.

A PROGRAM FOR UNDERGRADUATE CLASSROOM AND CLINICAL TEACHING OF PEDODONTICS[1]

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When one considers that only two decades ago dentistry for the child patient consisted of such practices as mild suffocation and the insertion of inadequate cement fillings, the use of general anesthesia to permit mutilation of young dentitions by extensive extractions, or an iron-bound technic to avoid dental services of any nature whatever for children, it is significant that precise instructional methods, manners and materials have been developed for teaching dentistry for children and now are being evaluated by the teaching staffs of the schools of dentistry. Instruction of undergraduate dental students in the care of child patients is achieving status.

Classroom Teaching of Pedodontics

In order to develop an outstanding program of classroom teaching in dentistry for children, an effort has been made to create a desire on the part of the undergraduate student to accept and treat child patients after graduation as a function of the general practice of dentistry. Having concluded that a child dental patient should be considered as an entire treatment unit, the teaching program of the Department of Dentistry for Children at the University of Michigan is guided by the immediate objectives which follow:

1. To provide the undergraduate student with practice in the detailed planning of treatment, based on a thorough examination and an accurate diagnosis, in order that dental services may follow an orderly pattern to completion;
2. To provide instruction in managing and directing the child patient's behavior in the dental office and the child-parent relationship before, during and after the dental appointment;
3. To provide instruction in modern root surgery and therapy for pulp involved teeth and the management of any condition involving teeth traumatized during accidents;
4. To instruct the student in the examination, diagnosis and treatment of any growth, development and health problem of childhood which legitimately is within the province of the general practice of dentistry;
5. To provide the student with ample knowledge for directing the child's and the parent's instruction in an adequate dental health program and for instituting all proven preventive measures developed to secure and maintain oral health;
6. To teach scientific operative procedures modified specifically for the primary and young permanent dentitions;

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[1]French Lick Springs, Annual Meeting, American Association of Dental Schools, 1951.

[2]University of Michigan College of Dentistry.

7. To provide experience in the utilization of the services of trained dental auxiliary personnel;
8. To provide instruction in office management practices for child patients so that dental services for children can be included as an economically desirable part of the general practice of dentistry; and
9. To stimulate a desire to pursue postgraduate education in dentistry for child patients.

To achieve such objectives, the formal lecture course in pedodontics is presented through staff lectures supplemented by mimeographed instruction materials; demonstration models and lantern slides; lectures by staff members of allied campus faculties; class discussion; and by library assignments which are designed to develop a background for the critical appraisal of the information which is available to a modern scientific dental profession and to develop an appreciation for scientific writing which utilizes good organization, literary style and the use of bibliographic reporting.

The 32 lecture hours in pedodontics are presented the second semester of the third year, specifically at this time to avoid a prolonged time lapse between the lecture course and clinical operating for child patients. Undergraduates in groups of twelve students each engage in the clinical practice of pedodontics during the senior year. Inasmuch as the dental examination, diagnosis and treatment of child patients requires a broad background from many of the sciences presented in the four-year dental program, an effort has been made to re-emphasize those portions of courses, preceding the pedodontic lectures, which are pertinent directly to the dental care of the child patient, to organize and to orientate the student's knowledge in the foundation science courses to the practice of dentistry for the child, and to teach new technics of treatment as well as modifications of technics learned during preceding semesters—modifications specifically developed for the primary and young permanent dentitions.

The lecture course in pedodontics is preceded by a comprehensive and objective questionnaire which explores thoroughly the practice of dentistry for children. Since the same questionnaire is given to the class at the conclusion of the lecture course, it provides the staff with a record of the student's achievement during the classroom course and his ability to modify some preconceived notions after exposure to scientific information. Students are taught that conclusions belong logically at the end of the scientific thinking process.

An orientation lecture is presented with the aid of lantern slides at the beginning of the lecture course to provide the student with a

preview of the course's content. Such an orientation period has proven to be stimulating to the third-year dental student and also has provided a method for outlining objectively the instructional material which the staff proposes to present during the semester.

Problems of health, growth and development in childhood are presented by the pedodontic and pediatric staffs. Included in this portion of the course is a review of individual growth and development of the child and the relationship of systemic diseases to growth, development and function; a comprehensive review of the growth and development of the teeth, jaws and face; a discussion of the morphology of the primary and young permanent dentitions which includes external anatomy, internal anatomy, the relationship of pulp chamber anatomy to cavity preparation, a comparison of the morphology of the roots and root canals of primary, young permanent and fully developed permanent teeth, the chronology of the human dentitions and space management problems of the anterior and posterior arches during the periods of the primary and young permanent dentitions.

Oral soft tissue diseases are presented with the aid of lantern slide demonstrations and case reports and are followed by a discussion of the relationship and treatment of the oral manifestations of systemic diseases.

In a review of radiographic technics, the uses of specific films for radiographic surveys of young patients is stressed. Radiologic diagnosis is presented with the aid of lantern slides designed to teach the interpretation of radiographs for routine dental examinations and for the detection of developmental anomalies of number, position, size, shape, structure and the exchange of young dentitions. The interpretation of a radiographic examination of the child to determine dental developmental levels for correlation with other evidences of development by the pediatric clinician, the speech correctionist and the educational researcher is taught objectively by demonstration case reports. Emphasis is placed upon the significance of modern scientific methods which treat the child as an organismic whole regardless of whether the primary interest of the science be one of dentistry, clinical medicine, genetics, educational psychology, nutrition or speech correction, to list a few of the sciences which are directly interested in the growth, development and welfare of the child.

During the portion of the lecture course, which relates to child dental training and behavior management, a first appointment practice pattern is presented for the preschool child. This practice pattern has as its

objectives the introduction of dentistry to a young patient in a comfortable manner; the purpose of examining the child as an entity rather than as a collection of unrelated structures and functions; the rendering of professional services in order to make the first visit a productive appointment; the utilization of psychologically approved methods for the dismissal of the preschool child patient; and the presentation of scientific patient and parent education along with the use of all proven preventive measures.

The indications, contra-indications and uses of therapeutic agents for sedation and anesthesia are presented during the lectures on the management of child behavior.

The following modified operative procedures are taught for the primary and young permanent dentitions:

1. Cavity preparations and silver amalgam restorations for the primary anterior and posterior teeth—restorations which are physiologically suitable for the pulps of the primary teeth, which have sufficient stuctural strength to withstand the stresses of mastication and restorations which restore the tooth functionally and anatomically to preserve the occlusion and to protect the gingival tissues;
2. Disking of primary incisor teeth when the incisal angle has been lost by accident or caries activity;
3. The use of cast restorations for extensively involved hypoplastic and pulpectomized molar teeth;
4. The reduction in size and reshaping of retained primary molars in the absence of a succeeding bicuspid tooth and the construction of a cast gold restoration contoured to approximate the size and shape of the missing permanent tooth;
5. Following radiographic and vitality examinations, treatment for fractured permanent incisors, which includes temporary sedative treatment, pulp protection and a susbtantial three-quarter cast crown restoration to acquire strength with a silicate window to secure esthetics;
6. The use of mat gold—gold foil restorations for young permanent teeth, and
7. The indications and construction of space-maintaining appliances for the primary, mixed and young permanent dentition periods including precise fixed anterior bridges.

Pulp management lectures, in addition to pulp protection practices for routine incipient and deep cavity preparations and fractured young permanent incisor teeth, include the examination, diagnosis and treatment of vital exposed pulps in primary and young permanent teeth, devitalized teeth, discolored crowns, fractured roots, loosened and displaced teeth and treatment for teeth completely removed from their sockets by trauma.

Office management practices are presented. The uses of auxiliary personnel, including the dental hygienist, the dental assistant, the dental laboratory technician, the pathology laboratory, health department and

caries laboratory services and the certified public accountant are discussed and evaluated. Office schedules are presented with special regard for the time and placement of new child patients' appointments, emergency appointments, recall patients and routine operative patient appointments. Office management practices are concluded with a discussion of the professional relations of the dentist and his staff to child patients and their parents, to dentists, physicians, laboratories and the community.

The lecture program in dentistry for children has been developed around a general curriculum which presents to the dental student instruction in the following areas of health, growth, development and treatment: child growth and development; oral pathology and diagnosis; dental caries control; periodontics; dental metallurgy and restorative materials; operative dentistry; radiography and radiology; dental therapeutics; prosthetics; orthodontics; oral surgery; and public health dentistry, in addition to the foundation science courses.

Repeating an introductory statement, the lecture course in dentistry for children is presented during the second semester of the third year immediately preceding clinical operating for child patients, in order to avoid a prolonged delay between the classroom course of instruction and its clinical application.

Clinical Teaching of Pedodontics

Eighty hours of scheduled clinical instruction and practice is provided for small groups of senior students. Most seniors acquire more than 80 hours of clinical instruction by returning to the children's clinic to complete treatment started during the prescribed clinic period and for further training in those examination, diagnostic and treatment technics which are of particular interest to them. Time has been reserved in the children's clinic schedule to permit continuous undergraduate clinical training each week of the senior academic year.

An announced preclinical written examination is presented to each group of students immediately preceding clinical operating. A comprehensive examination which investigates all areas of the lecture course has proven to be an effective method to promote a review of the lecture course and to improve the student's efficiency at the outset of the clinic period. An orientation lecture is presented to each group of students to familiarize the group with the children's clinic administrative practices and to promote accurate record keeping. Part of the first week in the children's clinic is devoted to staff demonstrations and student operating on six diameter plaster primary molar teeth with pink pulps and upon

ivorine manikin teeth with metal pulps. The ivorine teeth are articulated in child-size manikins that can be attached to a special support which replaces the headrest of the child-size dental chair and which then simulates actual patient operating conditions. The technic course includes the restoration of a fractured young permanent manikin incisor in addition to cavity preparations and silver amalgam restorations for primary teeth and silver amalgam and mat gold-gold foil restorations for young permanent teeth.

Patients assigned to the student for clinical treatment range in dental age from those with preschool primary dentitions to those nearing the end of the mixed dentition period.

Since clinical services must motivate the classroom instruction a brief outline of the activities and services taught and practiced in the children's clinic may be stated at the risk of some repetition:

1. Child training and behavior management in the dental chair and the child-parent relationship during the appointment period;
2. Examination, diagnosis and treatment planning which include a survey of
   a. Gross observable physical defects such as gait, stature, sight, hearing and speech
   b. Extra oral soft tissues of the head and neck
   c. Facial symmetry
   d. Intraoral soft tissues—lips, buccal mucosa, gingival tissues, palate, tongue, floor of mouth, salivary glands and throat
   e. Individual clean, dry teeth.
   f. Teeth in occlusion, anomalies of development and biting stress
   g. Oral hygiene
   h. Mouth habits
   i. Radiographic and radiologic determinations
   j. Dietary history
   k. Lactobacillus acidophilus counts and their significance
   l. Case history including chief complaint, if any, present illness, past history, systemic history and family history
   m. Record casts which supplement the oral and radiographic information
   n. Necessity for referral of patients
   o. Detailed appointment treatment program to assure services for all of the dental needs of the assigned patient
3. Prophylaxis, toothbrush instruction and home care of the mouth, including:
   a. Rubber cup polishing of teeth and toothbrush instruction
   b. Instrumentation for the removal of calculus
   c. Removal of stains
   d. Polishing of fillings
   e. Treatment of oral soft tissue diseases
   f. Patient instruction in scientific oral health practices along with the application of all proven caries-preventive measures

4. Practice of scientific modified operative procedures for the restoration of carious, anomalous and fractured primary and young permanent teeth with:
   a. Silver amalgam
   b. Silicate
   c. Mat gold-gold foil
   d. Cast gold
5. Pulp management technics for young dentitions are taught which include:
   a. Pulp protection following cavity preparation
   b. Aseptic partial pulpectomy treatment for exposed vital pulps in primary and young permanent teeth
   c. Complete pulpectomy technics for immature permanent teeth; and
   d. Pulp treatment for teeth injured during accidents
6. Detection and guidance of those childhood growth and developmental problems which are the responsibility of the dentist, such as:
   a. Tooth guidance technics for anterior cross bites
   b. Space management for the primary and mixed dentition periods and the
   c. Treatment of ectopically erupting molar teeth
7. Management of minor oral surgery problems
8. Use of therapeutic agents for young patients
9. Association with and the utilization of the student dental hygienist during clinic operating periods

At the conclusion of the 80-hour clinic training period for each group of students, the staff collectively evaluates the student for his clinical attitude and his operative skill in comparison with the other members of his group. Attitude consists of a composite evaluation which includes the student's personal and clinical neatness; cooperation with the staff's regulations for operating the children's clinic; interest; independence in completing assignments; and ability in child management. A short statement summarizing the staff's judgment of the student's achievement during the clinic training program accompanies the evaluations of operative skill and attitude.

The application of these activities in the children's clinic of an integrated school of dentistry, equipped to treat young patients and staffed to permit frequent individual demonstrations and close observation of the student's progress with a prepared treatment plan for each assigned child patient, provides a well-disciplined pedodontic training program for undergraduate dental students. Departmental staff meetings to evaluate methods and manners, as well as teaching material, aid in improving the training program in this modern field of science.

Changes in the training program also have been discussed by the staff

and the schood administrator, with the aim of improving the teaching program, including:

1. The introduction of operative technic instruction by pedodontic staff members during the first and second year of the dental curriculum. The change in curriculum distribution was not considered an immediate need, however, when the entire dental curriculum was surveyed this year and the amount of training provided by other dental staffs was found to be generous with respect to the consideration of the dental problems of young dentitions;
2. A change which has progressed past the preliminary discussion status concerns the addition of instruction in the management of hospitalized and handicapped children;
3. An increase in the number of undergraduate clinical hours of instruction is of great importance. The importance of this change in the clinic's training program in an integrated institution, weighted in significance with a reduction in clinic hours of instruction in some compensating portion of the undergraduate teaching program presents an administrative problem that has not been developed by the staff sufficiently in either the detail of administration or in the significance of the discussed change to warrant its justification for the faculty's consideration of this time.

These tentative changes complete the examination of the program in dentistry for children. In summary, it may be noted that this report outlines the objectives of the lecture course in pedodontics, states the objectives of the clinical program for training undergraduate students adequately to care for the needs of young dental patients and suggests some methods for achieving these objectives.

Discussion

PHILLIP BURWASSER, D.D.S.,[1] *Cleveland*

The outlined program for undergraduate instruction in pedodontics in the University of Michigan School of Dentistry indicates how much time and effort has been spent in its formulation and execution. The Department of Dentistry for Children is to be congratulated on the thoroughness with which it has explored the fields of pedagogy in its efforts to facilitate the teaching of this vitally important phase of dentistry. May I say that any of my comments or questions which may seem unduly critical of portions of the program are based on my own understanding of it. I hope that any misinterpretation on my part will be cleared up as the meeting progresses.

The list of objectives of the classroom teaching program is very com-

[1]Western Reserve University College of Dentistry.

prehensive. I presume that the order of presentation of these objectives is not significant and that the objectives may be subdivided into a major and a minor group. The "teaching of modified operative procedures," number six in the list, seems to me to be a major objective, while "experience in the use of auxiliary personnel," number seven in order of presentation, is a minor objective.

The time of presentation of the lecture course is important. Obviously there should be as little lapse of time as possible between the lecture course and clinical practice. At Western Reserve we have coped with this problem in another manner. Lectures in pedodontics are started in the last half of the second semester of the third year. The students are given the opportunity to operate on child patients on a voluntary basis during this half-semester. Since our clinics are open during June and July, these students have an additional opportunity to engage in clinical practice in pedodontics. The remainder of the lecture course is given in the first half of the senior year, by which time most of the students have had some personal contact with child patients and have gained an insight into the problems under discussion.

The use of a questionnaire examination before and after the lecture course is excellent, not only from the standpoint of evaluating the student's reactions, but also to provide the teaching staff with ideas for further modification of the course. There is the question of whether time can be spared for this type of exercise in some crowded curricula.

The presentation of lecturers from allied fields is certainly productive not only from the dental teaching standpoint, but also in promoting cordial interprofessional relationships.

It is my impression that the subjects of office management practice, use of auxiliary personnel and laboratory services are somewhat overemphasized. These subjects are not inherently and peculiarly related to dentistry for children. They are concerned with dental practice in general and possibly might be included to better advantage in courses in economics, practice management or public health.

With respect to the clinical teaching of pedodontics, it is my understanding that groups of 12 senior students are assigned to clinical duty for an 80-hour period. Is it possible that the first group of students might complete the 80-hour period and not work with children the remainder of the senior year? Are the students required to complete the work on their assigned patients or are the patients assigned to the succeeding group of students?

In the final analysis, pedodontics is the general practice of dentistry

for a group limited by its physiological and/or psychological age. As such, pedodontics cuts across every phase of dental teaching and practice. Is it possible that the attempt to include minor phases of dental school curricula in the formal pedodontics course may lead to duplication of effort and needless loss of time? Would the objective be more readily attained if members of pedodontics staffs acted as guest lecturers on the pedodontic aspects of the various other subjects in the dental curriculum?

The review of radiographic technics and radiologic interpretation and diagnosis is certainly a fundamental part of training in pedodontics. Needless to say, the modified procedures for maintaining and conserving the primary and young permanent dentitions are well emphasized.

The general examination of the child including notation of gross physical defects, recording of the case history, etc., is an important adjunct to treatment and is rightly emphasized in this program. This also applies to instruction in home care of the mouth and dietary guidance.

In conclusion, I wish to point out that the Department of Dentistry for Children of the University of Michigan has attacked the problem of the teaching of pedodontics on a broad front. The objectives are clear and the completeness of the presented program is a stimulus to members of similar departments in other schools.

THE CLINICAL IMPORTANCE OF ORAL HISTOLOGY[1]

In the Field of Oral Surgery With Special Reference To the Epithelial Attachment of the Gingiva

B. O. A. THOMAS, D.D.S., Ph.D.,[2] *Seattle*

At the outset I should like to stress the fact that this is a conference session of teachers. As teachers it is our duty to instill in our students a real appreciation of the fundamentals which they have previously learned by demonstrating to the students applications of basic science knowledge in clinical fields of dentistry. We have a splendid opportunity to do just this in the field of oral surgery. In the following discussion, although it may be necessary to speak of specific technics, this will be done only to illustrate a point of fundamental importance.

It must be accepted that there is no substitute for experience in the field of oral surgery. In spite of this, we realize that many of the important advances in oral surgery have come from application of knowledge gained in other fields of research and clinical experience. Serious surgical sequelae of a previous decade are inconsequential today as a result of antibiotic therapy. Not only in the field of treatment, but also in prevention and technics, oral surgery has made real advances in the past few years.

Most of us will agree I believe that the competent oral surgeon who understands the microscopic structure of the tissue upon which he works is better equipped to carry out clinical procedures than if he had no knowledge of the histology of these tissues. The field of oral histology is not small and we can best illustrate the points we wish to make by restricting our discussion to the subject listed in the title.

The literature contains many articles dealing with the details of the epithelial attachment and the importance of this structure in clinical dentistry. Gottlieb[3] almost 25 years ago discussed the details of the epithelial attachment and emphasized that passive eruption is a normal process. Becks[4] considered passive eruption as pathological. Kronfeld[5]

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[1]Presented before the Conference Session on Oral Surgery, American Association of Dental Schools, French Lick Springs, Indiana, March 21, 1951.

[2]Professor and Executive Officer, Department of Periodontology, University of Washington, School of Dentistry.

[3]Gottlieb, B.: Tissue Changes in Pyorrhea, *J.A.D.A.*, *14*, 2178-2207; Dec., 1927.

[4]Becks, H.: Normal and Pathologic Pocket Formation, *J.A.D.A.*, *16*, 2167-2188, Dec., 1929.

[5]Kronfeld, Rudolf: The Epithelial Attachment and So-Called Nasmyth's Membrane, *J.A.D.A.*, *17*, 1889-1907; Oct., 1930.

emphasized the organic union between the epithelial attachment and the tooth surface. Bodecker and Applebaum[6] showed ground sections of teeth and supporting tissues to illustrate the epithelial attachment. They agreed with Gottlieb's description of this attachment. Bodecker and Lefkowitz[7] emphasized the greater strength of the connective tissue attachment to the cementum than the epithelial attachment to the enamel. They stated that in the absence of inflammation reattachment of the epithelium to the enamel surface is possible. The work of many other investigators has gradually led to our present concept of the importance of the epithelial attachment of the gingiva to the teeth. Orban[8] has summarized the findings and presents the presently accepted concept in his textbook of oral histology and embryology. The following material is in agreement with this text.

Origin, Development and Structure of the Epithelial Attachment

During tooth development when the ameloblasts have completed the formation of the enamel matrix, they seal off the surface of the individual enamel rods by producing a thin membrane which is continuous over the surface of the enamel. This structure is spoken of as the primary enamel cuticle and it subsequently becomes highly calcified. After this cuticle is formed the various cell layers of the enamel organ become reduced to a few cells in thickness and this structure is then spoken of as the reduced enamel epithelium which covers the entire anatomical crown of the tooth. The developing tooth erupts towards the oral cavity and the reduced enamel epithelium over the tip of the crown fuses with the oral epithelium. As eruption continues the tip of the crown passes through the oral epithelium and enters the oral cavity. The reduced enamel epithelium, which remains in contact with the crown of the tooth so far as the cervical line, is now spoken of as the epithelial attachment. The epithelial attachment gradually separates from the surface of the erupting tooth, leaving a cuticular structure attached to the surface of the enamel. This cuticular structure is spoken of as the secondary enamel cuticle, is hornified and about 2 to 10 microns in thickness. By this means the enamel of the erupted tooth is protected on its surface by what has been called Nasmyth's membrane, consisting

[6]Bodecker, Chas. F., and Applebaum, Edmund: The Clinical Importance of the Gingival Crevice, *Dental Cosmos*, 76, 1127-1142; Nov., 1934.

[7]Bodecker, Chas. F., and Lefkowitz, Wn.: Gingival Reattachment to the Enamel and its Relation to Operative Dentistry, *Dental Cosmos*, 77, 1106-1114; Nov., 1935.

[8]Orban, B.: Oral Histology and Embryology, 2d ed. St. Louis: C. V. Mosby Co., 1949.

of the primary and secondary enamel cuticles. The oral epithelium and the epithelial attachment are continuous around the circumference of each tooth in such a manner that a shallow groove called the gingival sulcus is formed. The depth of this sulcus is ideally zero, but actually may vary from less than ½ mm. to as much as 4 or 5 mm. So long as there is no evidence of inflammation in the tissuse surrounding the gingival sulcus we cannot speak of the sulcus as being pathological, regardless of its depth.

It has been demonstrated that the attachment of the epithelial cells to the surface of the enamel or cementum is stronger than the attachment of the epithelial cells to each other. This results in tearing of the epithelial attachment between its cells rather than the clean stripping of the attachment from the surface of the tooth. This has definite clinical importance as regards the healing of the attachment following injury and laceration.

The actual movement of the tooth toward the occlusal plane is spoken of as active eruption. In most persons active eruption continues so long as the teeth are in the oral cavity. As the incisal or occlusal portions of the tooth are worn away through attrition, the tooth continues to migrate toward the occlusal plane. In contra-distinction to this active eruption of the tooth, the separation of the epithelial attachment from the tooth surface, gradually exposing more and more clinical crown, is known as passive eruption. This passive eruption has been divided into four clinical stages which can be briefly explained as follows:

1. During the first stage of passive eruption the gingival sulcus is on the enamel and the epithelial attachment extends from the base of the sulcus to the cemento-enamel junction. This is the condition seen in the recently erupted teeth and may persist for several years.
2. The second stage of passive eruption exists when the gingival sulcus is found on the enamel and the epithelial attachment extends from the base of the gingival sulcus to some point on the cementum-covered root surface. It should be mentioned that in order for the epithelium to proliferate along the root surface of the tooth, it is necessary that the periodontal membrane fibers in the area become detached from the cementum surface. This second stage of passive eruption may persist for many years.
3. The third stage of passive eruption exists during that brief period when the base of the gingival sulcus is located exactly at the cemento-enamel junction and the epithelial attachment is located entirely on the cementum of the root.
4. When the gingival sulcus and the entire epithelial attachment are located on the root surface, we speak of this condition as the fourth stage of passive eruption. This is ordinarily seen in older persons or in areas which have been subjected to abnormal stresses. It may be well to remind ourselves that the rate of passive eruption varies markedly between individuals and also between teeth in the same

individual, as well as upon different surfaces of the same tooth. Although we do not understand completely how the epithelium is attached to the surface of the tooth, there is good evidence that there is a definite organic continuity between the epithelial attachment and the enamel or cementum surface. It is not difficult to understand this connection between the enamel and the epithelial attachment because the epithelial attachment is merely the remains of the enamel organ which originally produced the enamel. The epithelial attachment on the root surface is held in position by slender processes from the epithelial cells which extend into irregularities of the cementum surface previously occupied by periodontal membrane fibers.

With this description of the normal epithelial attachment of the gingiva to the tooth surface, let us apply this information to the field of clinical oral surgery.

Incisions and Surgical Flaps

If we can agree that it is important to respect the integrity of the epithelial attachment of the tooth in order that inflammation and infection of the sub-epithelial connective tissues be avoided, let us examine how this can best be accomplished in oral surgery operations requiring the use of incisions and flaps in the vicinity of the teeth.

It should be stated that what we are about to say applies particularly to the normal condition of the epthelial attachment. When we are dealing with cases of gingival or periodontal disease, the epithelial attachment is not normal and we are not concerned about interfering with this pathological condition. It should again be emphasized that we must think in broad, fundamental terms. The principles and ideas which we implant in the minds of our students will bear fruit for many years to come. We should, therefore, see that the technics we teach are based on sound fundamentals.

In one well-known recent oral surgery book[9] the author shows many illustrations of incisions and flaps in relation to tooth removal. In one chapter all illustrations show the stripping of the epithelial attachment from the teeth. In the next chapter relating to the removal of impacted teeth, the predominant technic is the same—tearing of the epithelium and gingival connective tissues from the teeth in order to lay back the flap and expose the underlying bone. In two or three instances where the impacted teeth lie some distance from the erupted teeth, the flap is prepared without involvement of the epithelial attachment. The author, however, strongly advocates the use of the method by which the gingival tissue is retracted from the cervical area of the tooth. Undoubtedly this

[9]Mead, Sterling V.: Oral Surgery, 34th ed., ch. II, XX, XXI, XXII. C. V. Mosby Co., 1946.

competent surgeon has achieved satisfactory results from the methods which he advocates or he would not advise their use. It is possible, however, that at a later date some of the patients so treated developed periodontal lesions as a result of this type of incision and flap operation. It appears that this is physiologically contraindicated. Clinical results might be even more satisfactory were this surgeon to avoid, wherever possible, injury to the epithelial and connective tissues attached to the teeth.

Earlier in this same book we find the following statement, "There are numerous mucous glands situated in the gums, especially numerous near the necks of the teeth." We know, of course, from abundant histological evidence, that this is not true. This oral surgeon is not unique in his lack of correct histological knowledge because in another well-known oral surgery book,[10] published 34 years earlier, we find the following statement, "The gum resembles the soft tissue of the hard palate and contains large mucous glands. These are especially numerous near the necks of the teeth." This last sentence has been apparently transferred, word for word, into the works of the author mentioned above.

G. V. Black[11] in his volume on "Special Dental Pathology" did not mention glands in the gingiva. If we pursue this point even further into the early dental literature, we find in Litch's "American System of Dentistry,"[12] published in 1886, mention of a gland-like epithelium in the gingivae "that suggests the formation of a gland but fails to assume the glandular structure." Even at that early date the authors doubted that these gland-like epithelial structures were glandular in nature. We have known now for many years that the marginal gingivae are free of glands. These references have not been presented merely to waste your time, but to show that sometimes we perpetuate in our literature and in our teaching certain statements which are incorrect. Let's try to be a little more certain of our facts!

Another author[13] writing on an oral surgery subject says, "One maxillary cuspid is to be removed. An incision is made along the midline on the palate extending to the gingival margin of the central incisor and circling around the incisive canal prominence. The interdental tissue between the incisors, the cuspid and the bicuspid, is incised. . . . This type of reflection of palatal tissue is very conservative. . . .

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[10]Blair, Vilray P.: Surgery and Diseases of the Mouth and Jaws. St. Louis: C. V. Mosby Co., 1912.
[11]Black, G. V.: Special Dental Pathology. Chicago: Medico-Dental Publishing Co., 1915.
[12]Litch, W. F., Editor: The American System of Dentistry, vol. I. Philadelphia: Lea Brothers and Co., 1886.
[13]Luck, B. E.: Soft Tissue Surgery, *J.O.S.*, vol. 2, July, 1944, pp. 222-226.

Sutures placed in the interproximal spaces insure reattachment of these tissues." Perhaps we should ask the question, "Of what is this type flap conservative?" Perhaps the vascular supply is well-conserved, but what about the epithelial attachment to the palatal and interproximal surface of these maxillary teeth, and what about the thin alveolar crest which is exposed during the surgical operation? If the soft tissues are not returned very accurately to their original positions, the possibility of recession and of accelerated epithelial downgrowth on the root surface is very great. This is, of course, the initiation of periodontal disease. If inflammation develops in the area, the possibility of reattachment is definitely decreased.

Further examination of the literature makes it evident that other men in the field of oral surgery have taken cognizance of the importance of avoiding injury to the epithelial attachment. The author of a text concerned with the removal of the impacted mandibular third molar[14] is careful to prepare the flap so as to include none, or very little, of the tissue attachment of the second molar. Another writer in his two books on oral surgery[15,16] specifically states and illustrates that the incision in preparation of flaps for removal of maxillary and mandibular third molar impactions should avoid gingival margin. One of our best-known oral surgeons published a journal article[17] which contained illustrations in which the flap for removal of impacted mandibular molars does not interfere with the epithelial attachment of the second molar. Ten years ago another writer presented drawings to illustrate incorrect and correct incisions for preparing flaps to remove granulomas and cysts.[18] He states, "Figure 5 demonstrates an incorrect incision. . . . In the first place the flap should not be turned toward the median line, and in the second place there would be in this instance a recession of the gingival margin about the cuspid and there would follow an erosion and extreme sensitivity." This author understands that damage to the epithelial attachment is not desirable and can be avoided.

Summary

We should realize that as teachers we have obligations in addition to those which we have as clinicians. We should not employ technics

[14]Winter, Geo. B.: Impacted Mandibular Third Molar. St. Louis: Amer. Medical Book Co., 1926.
[15]Winter, Leo: Operative Oral Surgery, 2d ed. St. Louis: C. V. Mosby Co., 1943.
[16]Winter, Leo: Textbook of Exodontia, 5th ed. St. Louis: C. V. Mosby Co., 1943.
[17]Thoma, Kurt H.: A New Method of Space Obliteration After Odontectomy, *A. J. Ortho. & O. S.*, 31, 198-205; April, 1945.
[18]Mallett, Stephen P.: Incisions and Flaps, *A. J. Ortho. & O. S.*, 27, 502-504; Sept., 1941.

because they are expedient, if by employing such technics we violate basic principles of tissue physiology. The epithelial attachment is an important structure and it is definitely injured by procedures which tear it from its attachment to the tooth. The epithelial attachment may not reattach in its former position following such tearing. Failure of proper reattachment leads to the development of gingival recession and/or pocket formation. Several factors such as time, trauma, inflammation, contamination, etc., influence the possibility of epithelial reattachment. Since we know the possible sequelae to stripping of the epithelial attachment, let us as teachers, wherever possible utilize surgical technics which do not tear this attachment and which will utilize the basic fundamentals which our students have learned during their preclinical years in dentistry. By so doing, we advance the aims of teaching and improve the quality of clinical practice.

COLLEGE NEWS

Edited by SIDNEY EPSTEIN, D.D.S., *San Francisco*

University of Illinois:

ANNOUNCEMENTS

The university announces several courses in the field of graduate education throughout the year 1952, including a two-year full-time course in the basic sciences.

University of Pennsylvania:

APPOINTMENTS

Milton H. Rode, D.D.S., chairman, department of prosthetic dentistry.

Claude S. LaDow, D.D.S., chairman, department of oral surgery.

H. M. Berry, D.D.S., assistant professor of roentgenology.

University of Pittsburgh:

ANNOUNCEMENTS

The university announces a one-semester course in first aid.

University of Tennessee:

APPOINTMENTS

R. H. Campbell, Jr., D.D.S., and E. S. Lane, D.D.S., to the division of crown, bridge and partial denture prosthesis.

M. P. Bull, D.D.S., and Carl Anderson, D.D.S., division of oral surgery.

Josephus T. Patrick, D.D.S., division of full denture prosthesis.

E. Earl Davis, D.D.S., and William L. Scholes, D.D.S., division of operative dentistry.

ANNOUNCEMENTS

The university announces as this first course in postgraduate work under the direction of L. W. Kibler, D.D.S. Other instructors in this first course, children's dentistry, will be Chester Lloyd, D.D.S., Faustin N. Weber, D.D.S., and James T. Ginn, D.D.S., Dean of the school.

Temple University:

ANNOUNCEMENTS

With the refurnishing of the oral diagnosis clinic, a plaque in memory of the late Gordon Winter, D.D.S., will be placed in his memory.

Announcement is also made of a graduate course in the fundamentals of occlusion in relation to physiological and pathological conditions of the supporting tissues of the teeth.

The school expresses satisfaction in the use of professional proctors.

PARTIAL DENTURE PROSTHESIS[1]

Panel Discussion[1]

Moderator: O. C. Applegate, D.D.S., University of Michigan.
Members of Panel: T. R. Moore, D.D.S., Washington University
J. V. Olson, D.D.S., University of Texas
Chester Perry, D.D.S., University of Detroit
Loren D. Sayre, D.D.S., Northwestern University

CLINICAL PROCEDURES FOR MOUTH PREPARATION IN PARTIAL DENTURE CONSTRUCTION

A list of twelve questions was submitted to be considered and discussed by the panel in an effort to arrive at the reasonable answers for the guidance of teachers in partial denture departments of dental schools. Dr. Applegate, acting as moderator, selected the questions in the order which seemed to him most appropriate. When two questions were similar, or there was an overlapping of thought, both were discussed simultaneously to conserve time. The session proved to be a very valuable one inasmuch as the panel brought forth quite interesting, varied, and constructive comments. Also, the attendance at this session was excellent throughout the whole period, with a great amount of audience participation. As a result, opinions were expressed and discussion came forth from other dental teachers besides just those four who comprised the panel.

It can be said in all sincerity that the Moderator, Panel, and audience alike seemed sincerely interested in the problems presented and that all made a worthwhile contribution towards better Removable Partial Denture Teaching.

Questions and Digest of Discussions

1. A new patient comes to clinic for the first time with missing teeth. Should this patient go first to Partial Denture Department or to the examining room for assignment to a student?

It was the consensus of the panel that the patient should go *first* to the Department of Oral Diagnosis. Following this, radiographs and study casts of the patient should be procured. At this point, the patient is ready to be taken to the Partial Denture Division for proper guidance in complete mouth rehabilitation. It was suggested that "Mouth Rehabilitation" should apply to the more simple corrections as well as to complete rebuilding of the Masticatory Apparatus.

In the discussion, it was brought out that a patient should always go to the general diagnostic department *first*.

2. In the event this patient is sent first to the student, how far should this student carry the treatment before examination in the Partial Denture Department?

It was the feeling of the group, as stated under No. 1, that the student, upon receiving the patient, should proceed immediately to the division

[1]American Association of Dental Schools, Annual Meeting, 1951 (S. T. W. Chairman), French Lick Springs.

of general oral diagnosis. Then, as soon as X rays and mounted study casts are ready, he should present the patient for consultation with the responsible person heading the partial denture division, where, together, they would be able to map out the definite procedures.

3. How best can we get cooperation between the departments, such as Crown and Bridge, Operative, Periodontia and Root Surgery, as to an evaluation of the case leading to a final diagnosis?

The panel concluded that, ideally, there should be complete representation of departments on the diagnostic staff. However, they sensed the impossibility of having such a set-up, since most schools have teachers present *part-time*, and since it would be almost prohibitive financially to support such a diagnostic staff. They recognized, further, the impossibility of having any one individual so well trained in diagnosis and treatment planning to, alone, correlate all departments and all procedures.

Accordingly, in view of the well understood limitations imposed by conditions presenting at individual schools, it was suggested that interdepartmental cooperation could be further augmented by:

a. Departments meeting together for better understanding and appreciation of teaching objectives.
b. Departments concluding, together, on procedures which will best teach.
c. Rotation of faculty members to different departments for broader experience.

4. Should the prospective partial denture patient with necessary operative restorations be given preference by the operative departments over the patients coming in for only operative dentistry?

The "experts" answering this question echoed an emphatic "Yes," that a patient requiring both operative work and a partial, too, should be given preference. Nevertheless, they made it clear that it is difficult to show this preference since the faculty, as well as patients, do not condon favoritism. They concluded, therefore, that ideally, preference is *deserved* by such a patient who doesn't get it simply because the ideal breaks down in practical application.

5. As operative procedures necessary for partial dentures such as occlusal plane alignment and abutments are of a complicated nature, how can these best be handled so the same student can complete the partial denture?

Students should and need to be stimulated, agreed the panel, to do difficult procedures as well as simple, easy ones. "Bonus points" were suggested to do this stimulating since they deemed it best, as a general rule, that cases be carried through from start to finish by the same student. Such a plan provides for the student the greatest possible wealth

of experience. By a bonus, he will be encouraged to do this; also, he will want to get the case finished to gain the bonus points.

However, procedure is influenced by the necessities. Accordingly, certain operative work *may* be advantageously assigned to other students who happen to need a particular kind of experience. In such cases, requirements may be waived. Also, when a student does not have time near graduation to complete all mouth preparation procedures or to construct the partial, such cases, carried over, create a favorable reservoir from which such requirements can be drawn to fill certain students' needs.

6. How should a combination case (e.g., single maxillary and partial mandibular) be handled? The maxillary by the complete denture and the mandibular by the partial denture or should both be handled by the Partial Denture Department?

The consensus of thinking among the panel was that if the clinical instructors all work together in the department of general prosthesis, there really arises no problem with reference to the situation under question No. 6, even though complete and partial lectures may be given separately. But, where complete and partial teachings operate under separate divisions, it is much more difficult to correlate work. Differences develop with reference to ideas of occlusion, balance, tooth alignment, ridge relationship, etc., etc. Therefore, when the departments function separately, the panel concluded that each should supervise the construction of, and give credit for, the particular denture falling within its category.

7. As a teaching institution how far are we obligated in accepting all cases coming into the school?

It was the thinking of the group that only such cases as are helpful in teaching and which enable us to fulfill our obligation to the *undergraduate* student are our responsibility to accept.

8. Does the Department of Diagnosis consider the alterations in the mouth that are necessary to successfully prepare the arch to receive the partial denture at the time of diagnosis?

On this question, the panel collectively agreed in substance: "Yes, in a general way, the division of oral diagnosis does consider the various mouth alterations before final impressions, and tries to visualize the problems involved in order to *properly assign patients to students*, but not to the extent of planning and directing departmental procedures."

9. Does the Department of Orthodontics cooperate with the Department of Partial Dentures in taking the necessary steps of orthodontic intervention in making the mouth ready to receive the partial denture?

Panel group discussion, together with audience participation, brought forth the strongly alleged statement that there is not too good a cooperation between the Departments of Orthodontics and Prosthodontics in the dental schools, generally.

Inability to have an ideal working relationship between the two departments seems to be due to the fact that cases are either too difficult (or too late) to yield to orthodontic treatment or the needs of the patient are immediate and cannot wait for corrective tooth movement.

10. Is there integration between the laboratory teaching curricula and the teaching in the Partial Denture Clinic?

Answers from the four-man panel, as well as from various school representatives in the audience, brought to light that lectures are more or less closely integrated in most schools between laboratory and clinical procedures. It was indicated further, that close integration avoids confusion to the students by preventing the expression of differences of opinion by various instructors, and that this close integration can best be accomplished by having the same one lecturer for both laboratory and clinical exercises.

11. What integration is there between the didactic presentation of the course of partial denture and the laboratory and clinical execution?

With reference to what integration there is, or should be, all the way through from didactic presentation to ultimate clinical execution, the panel stated unequivocally that there should be *complete integration* and that the preclinical and clinical teaching should be done *by the same lecturer*.

12. Should a complete tentative plan of treatment be made by all departments concerned before the work is started?

In answer to this question, the consensus of the panel of experts summed up that each student should develop the habit of depending upon himself to some extent by diagnosing his case within the limits of his ability, then having his diagnosis checked and corrected by instructors and department consultants. At this point a complete plan of treatment should be outlined. A quite definite treatment sequence *must* be set up in order that the student will not become bewildered and discouraged by being tossed from department to department with consequent successive changes in procedure, and possibly even the loss of the patient.

The group emphasized the stark fact that an *ideal Diagnostic Department* would have present at all times *a physician and all department chairmen*.

VICTOR L. STEFFEL, *Secretary*.

BOOK REVIEW

The Physiological Foundation of Dental Practice.[1] The intent of this book, according to the preface, is to present the basic data of physiology with an emphasis on those aspects and examples which will be in accordance with the needs and interest of the dental practitioner.

Such a book might have a valuable place in a dental school, but the present work falls far short of the ideal. Without regard to which special group a text book on physiology is addressed, it should first of all be as good or better a text for the basic study of physiology than are the existing books. It is on this essential requirement that we feel this book fails. In general, the material is presented in a rather dogmatic, conclusive fashion, turgid with definitions (which can be looked up in any medical dictionary), and more in the style of a "cram" book in which the spirit of physiology as an experimental science is almost completely lost. Many people are beginning to pay at least lip service to the idea that an understanding of basic concepts is a more useful achievement for the student than a mass of facts and figures. But how does one achieve such an understanding? We believe that to understand the basic principles and concepts, and to be able to apply them intelligently, requires some familiarity with the outstanding lines of evidence which form the basis of the prevailing working theories in each area. The most successful textbooks in any scientific field have probably been those in which this approach was accomplished with the greatest skill, clarity, and brevity.

The authors of the text have an unhappy habit of tossing in purely gratuitous remarks which have no experimental foundation whatever. In the confused account of the isometric length-tension diagram, page 55, they state: "The mechanism by which an increase in initial (*sic*) length of a fiber increases the force of contraction is still obscure. However, since lengthening of a muscle fiber increases the active surfaces, this factor may play a role, particularly since the liberation of energy may be a function of surface area." In the section dealing with dental caries, which is treated in a most superficial manner (and might be omitted in any case) the authors, in discussing the role played by the ingestion of fermentable carbohydrates, suggest; "it may be that the presence of fermentable carbohydrates in the diet makes for a reduction of other foodstuffs which may be protective and prevent the development of dental caries." In discussing nerve block, on page 39, the authors state; "it can be demonstrated that—the impulses reach the blocked area, jump across this region and are resumed on the central side." While jumping over a block has been demonstrated *in vitro* under certain very special conditions, we are not aware of any direct evidence that it occurs or has any significance under the conditions of clinical nerve block, in which context it appears in the book.

On the question of whether the desirable emphasis of content and examples for dental students has been achieved, aside from the quality of a physiology book *per se*, our reaction is mixed. We agree wholeheartedly with the authors' contention that brevity is desirable, but this should not mean mere reduction in total pages. There is an attempt to include in the book too much material which might be related to dentistry. In addition, several sections of purely anatomical nature ought to be left to anatomy courses,—for example, most of the section on cranial nerves.

Also, examples involving straight pathology could be omitted, unless they directly serve to heighten the physiological interest or more especially if they serve as exer-

[1] L. L. Langley and E. Cheraskin, Department of Physiology, University of Alabama School of Dentistry. C. V. Mosby Co., St. Louis, 1951; 511 pages, 149 illustrations.

cises in the application of physiological principles to practical situations. More of the latter would be highly desirable in helping the student to transfer his physiological knowledge to other areas. The utilization of physiological examples involving parts or functions of greater interest to the dentist are sometimes quite good; but sometimes they seem to be rather forced. On the other hand, some aspects have been omitted which one feels properly belong in such a textbook—for example, Moyers' electromyographic studies of the muscles of mastication; the important studies of Hoff and Breckenridge on respiration; Penfield's view on the functions of the cerebral cortex versus thalamus. Strangely enough, the name of Trueta is mentioned in the book on three occasions, although it is by no means clear what the significance of his studies on renal shunts will prove to be for human physiology. The entire treatment of the nervous system is inadequate and relatively anatomical.

A student, after reading the present book, might believe that he knew all about the subject. Actually, his knowledge would be superficial, would be incorrect in many respects, and his ability to apply a physiological approach to the problems of dentistry would hardly have been developed at all.

In view of the above considerations, the book under review cannot be recommended by us as an adequate book for the teaching of physiology in schools of dentistry.—Benjamin Libet, Ph.D.,[2] and H. J. Ralston, Ph.D.[3]

BOOK ANNOUNCEMENTS

Handbook of Dental Practice (Lippincott): This is the title of a book, second edition, edited by Louis I. Grossman, D.D.S. This is a book of 503 pages, including an index, 388 illustrations and five color plates. Including the editor of the book, there are 20 contributors, representing various phases of dental practice, and all of whom are well known in the profession as authorities and capable teachers. Published by Lippincott & Company. Price, $10.00.

Dental Formulas: This is a compilation of formulas, including some which may be original, together with original comments and dissertation by the author, Dr. Louis I. Grossman, D.D.S., associate professor, oral medicine, school of dentistry, University of Pennsylvania. It consists of 318 pages, with an index, 25 illustrations, and one in color. Published by Lea & Febiger, Philadelphia.

Public Health Reports: This is a paper-bound book of 120 pages, consisting of conferences and health reports, etc. Published by the United States Government printing office, Washington 25, D. C. Price, 55 cents.

Dentistry as a Career: This is a pamphlet, issued by the Canadian Dental Association, designed to interest young people in the profession. It may be had on application to the Canadian Dental Association, Toronto, Canada.

℞ for Medical Writing: This is a little book of 112 pages with an index, designed to assist those who write theses, reports or whatnot for their professional confreres. It may even be helpful in similar undertakings for the lay public. Instruction is included pertaining to the use of illustrations, statistics, footnotes as well as the body of the text with special considera-

[2]Assistant Professor of Physiology, Colleges of Dentistry, Pharmacy and Medicine, University of California, San Francisco.

[3]Associate Professor of Physiology, College of Physicians and Surgeons, School of Dentistry, San Francisco.

tion to both ends—the beginning and the ending. The chapter devoted to building the index is very good. Publisher, W. B. Saunders Co., Philadelphia. Price, $2.50.

The Porcelain Jacket Crown: This is a book of 273 pages, with an index, by S. Charles Brecker, D.D.S., formerly Assistant Professor of Operative Dentistry, New York University, College of Dentistry. It is profusely illustrated with a frontispiece in color. Published by C. V. Mosby Co., St. Louis. Price, $8.00.

Clinical Dental Roentgenology: This is the third edition of this book by the authors, John Oppie McCall, D.D.S., and Samuel S. Wald, D.D.S., Clinical Professor, Oral Cancer and Roentgenology, New York University, College of Dentistry. It consists of 380 pages with an index and is profusely illustrated. This edition contains great extension of material over preceding issues. It should be of greater usefulness to the profession. Published by W. B. Saunders Co., Philadelphia. Price, $8.50.

Current Therapy: This is an annual publication under this title and is a book of much real information as to the modern methods of treatment. The idea of the book is that two or more men of recognized ability in practice of medicine are asked to submit their methods of treatment of certain diseases. There are 359 contributors, 12 consulting editors and an editor-in-chief, Howard F. Conn, M.D. It consists of 849 pages with an index, and is designed primarily for practicing physicians. It is of no small value to the dentist as a book of information. Published by W. B. Saunders Co., Philadelphia. Price, $11.00.

IN MEMORIAM

Announcement is made of the great loss suffered by the death of Dr. E. G. Sloman, Dean, of College of Physicians and Surgeons, and of Dr. James Nuckolls, Professor of Basic Sciences, University of California. Our two schools and the profession mourn their loss.

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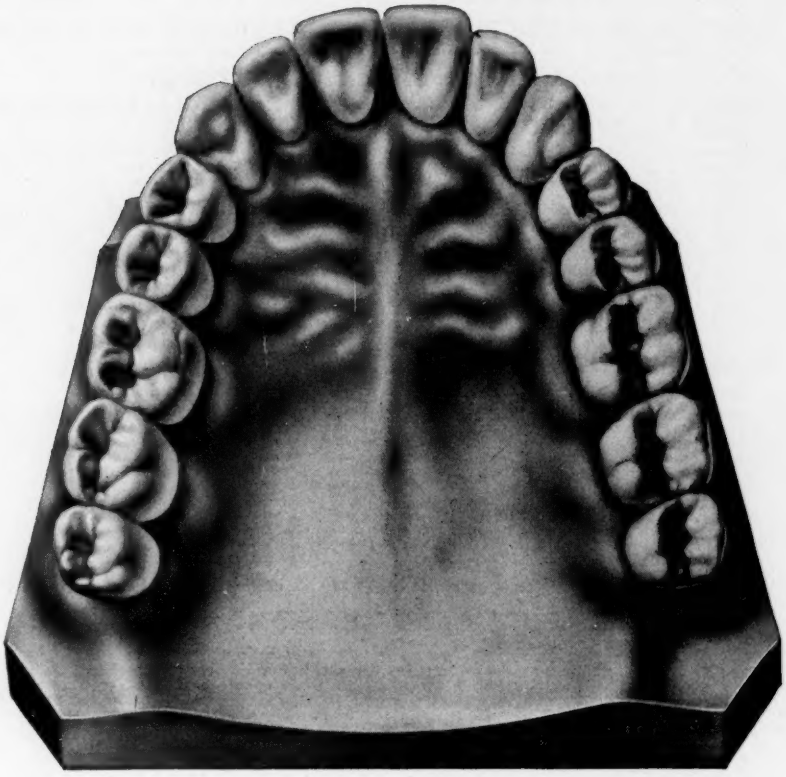

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